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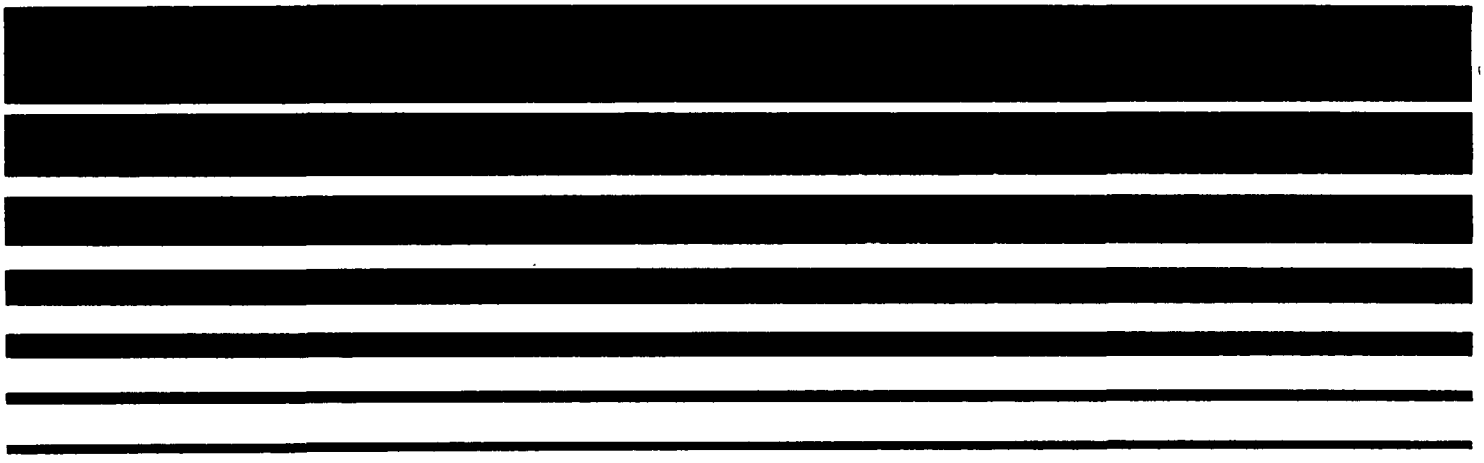
# EPA Supplemental Guidance for I/M Programs:

# Vehicle Repair, Technical Assistance, Performance Monitoring, and Technician Education and Certification



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# Vehicle Repair, Technical Assistance, Performance Monitoring, and Technician Education and Certification

Emission Planning and Strategies Division
Office of Mobile Sources
U.S. Environmental Protection Agency
Final -- September, 1994

# APPENDICES

# APPENDIX 1

# IM240 Repair Verification: An Inexpensive Dynamometer Method

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940431

# IM240 Repair Verification: An Inexpensive Dynamometer Method

**Jan B. Mickelsen and William B. Clemmens**
U.S. Environmental Protection Agency

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940431

# IM240 Repair Verification: An Inexpensive Dynamometer Method

Jan B. Mickelsen and William B. Clemmens
U.S. Environmental Protection Agency

## ABSTRACT

An inexpensive system was designed that would allow repair shops to verify the adequacy of repairs made to cars that had previously failed the new high-tech I/M test (IM240). Before and after repair tests on a limited number of vehicles were performed with both official IM240 and prototype repair grade (RG240) equipment systems. Analyses were performed to determine if the RG240 system concept is capable of determining if the repairs performed resulted in adequate emissions reductions to assure a passing IM240 retest. This study focuses on development of a prototype RG240 system consisting of a 100 SCFM CVS, a dynamometer with an eddy current power absorber and non-adjustable 2000 pound inertia flywheel, and a BAR 90 emissions analyzer with an additional nitric oxide analyzer.

## INTRODUCTION

In November 1992, EPA promulgated regulations [1]* requiring enhanced I/M programs in many areas of the country, including all serious and above ozone areas. These programs will require I/M testing and repair to be separate. Accordingly, the ability of the automobile service/repair sector to verify that effective repairs have been made prior to returning the vehicle to the test center for retesting is important to achieve a smooth running program and to garner public acceptance.

Because the official IM240 transient emissions test is performed with specialized testing equipment, diagnosing failed vehicles and verifying that subsequent repairs were sufficient to adequately reduce emissions to passing levels may be considerably easier with similar specialized equipment. In response to this, the EPA conducted a preliminary study of a relatively low cost IM240 repair verification equipment system. This repair verification (or repair grade) equipment system is termed the RG240 in order to avoid confusion with the more thorough official IM240 test equipment.

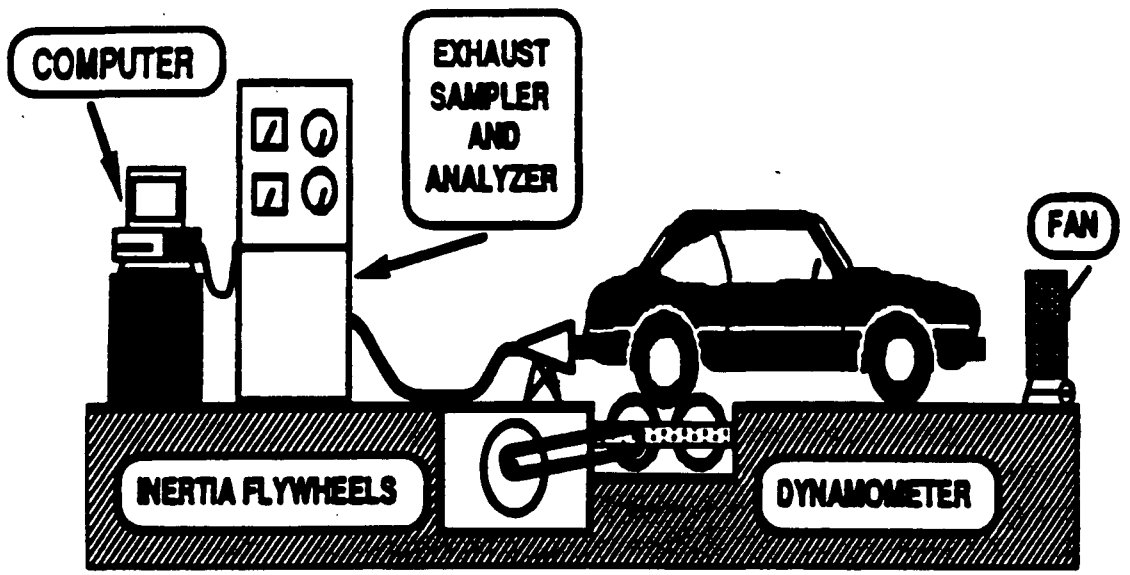
The IM240 is a transient emissions test which measures hydrocarbons (HC), carbon monoxide (CO), carbon dioxide ($CO_2$), and oxides of nitrogen (NOx). The test was

* Numbers in brackets denote references listed at the end of the paper.

developed from the Federal Test Procedure (FTP) by the EPA in order to improve the effectiveness of Inspection and Maintenance (I/M) tests on new technology vehicles [2]. The driving schedule for the IM240 is 239 seconds long (240 data points) and is derived from the first two "hills" of the EPA Federal Test Procedure (FTP). Unlike the FTP, which contains a cold engine start, the IM240 requires that the engine be warmed up and running before the driving schedule starts.

The RG240 was developed using the same operating procedures and equipment concepts as the IM240. The RG240 uses the same driving schedule as the IM240. It also uses a dynamometer and measures mass emissions. RG240 mass emissions are calculated for each second and summed to get a composite total following the same procedure as the IM240. Only composite emission results are discussed in this paper. Comparisons of RG240 and IM240 second by second emissions will be addressed in a future paper.

**Figure 1**




**IM240 EQUIPMENT AND CONFIGURATION**

There are many equipment similarities between the two tests in that the IM240 is designed to produce similar power loading as the FTP (Figure 1). Mass emissions are also measured during the IM240, instead of emissions concentrations used by current idle and steady state I/M tests. The IM240 mass emission measurement uses a constant volume sampling system (CVS) like the FTP, and a new generation of gas analyzers which allow real time exhaust analysis resulting in emission values for each second of the IM240.

Costs for the RG240 were reduced by using a simpler dynamometer which is adjustable for vehicle load, but has a fixed 2000 pound inertia weight. HC, CO, and $CO_2$ emissions analyses are performed with a BAR 90* emissions gas analyzer. For this study, two nitric oxide (NO) sensors which operated in parallel were used. The constant volume

* BAR refers to the California Bureau of Automotive Repair. BAR 90 refers to a class of I/M analyzers currently in-use in many test-and-repair I/M programs.

sampler was fabricated at the EPA's National Vehicle and Fuels Emission Lab and uses a critical flow venturi rated at approximately 100 standard cubic feet per minute (SCFM).

## RG240 TEST EQUIPMENT

One of the main concerns during the development of the RG240 concept was to keep the "retail" cost of the developed system as low as possible. Accordingly, the RG240 is based on equipment which already exists in repair shops, or is substantially less expensive than the corresponding IM240 equipment.

IM240 dynamometer specifications require coupled twin rolls and an adjustable power absorber which can be adjusted in 0.1 horsepower (Hp) increments [2]. The simulation of vehicle inertia may be achieved by using flywheels which range from 2000 pounds to 5500 pounds in increments no larger than 500 pounds. In addition, IM240 dynamometers using mechanical inertia are required to have an independent method to verify that the correct flywheels are actually rotating during the test.

The RG240 dynamometer used in this program also has twin rolls but, for this initial study, they were not coupled. Future EPA evaluation programs will probably use coupled rolls. The RG240 dynamometer used only one permanently engaged 2000 pound flywheel. An eddy current power absorber was used and was adjustable in 0.1 Hp increments.

The use of a fixed 2000 pound inertia weight on the RG240 will underload heavier vehicles on the acceleration portions of the driving schedule in comparison to the IM240. This should cause lower RG240 emissions, but because the RG240 determines a more qualitative change from the before and after repair tests, the effect should be negligible. Future tests of the RG240 concept may include the addition of simulated inertia by increasing the load of the dynamometer's power absorber during the acceleration portions of the driving schedule.

In order to measure mass emissions from vehicles during testing, it is necessary to know both the volume of exhaust air flow and emission concentration. Both the IM240 and RG240 equipment systems use a CVS which performs two functions, dilution of the exhaust with air, and a surrogate measurement of the vehicle exhaust flow through measurement of an air diluted exhaust mixture. Both emissions tests also use an exhaust collection tube which is much larger in diameter than a vehicle's exhaust pipe. The collection tube is positioned around the vehicle's exhaust pipe and draws additional air used for dilution around the exhaust pipe. The vehicle's exhaust is diluted so that water condensation and further reaction of emissions will not occur. The air flow in the CVS used for this study was regulated by the use of a critical flow venturi (CFV). The CFV limits airflow by creating a sonic shock wave in the throat of the venturi. Once a CFV has been calibrated, the air flow volume can be determined by measuring the inlet temperature and pressure at the venturi. The diluted exhaust flow is also sampled at the inlet to the venturi and transported to the emissions analyzer benches.

The recommended flowrate for an IM240 CVS is approximately 700 SCFM (without heated sample lines) while the RG240 CVS flow was approximately 100 SCFM. The lower flow rate was selected for the RG240 in order to reduce equipment costs by using a lower power CVS blower motor, and to keep the emission concentrations in the range of a BAR 90 type emissions analyzer. The IM240 CVS uses a "L" type probe to sample emissions from the center of the flow stream. Because the RG240 CVS design

produces less cross-stream mixing of the diluted exhaust, the RG240 probe was redesigned to sample across the entire flow stream. The redesigned probe substantially improved calibration of prototype units, and reduced variability due to incomplete cross mixing. All tests reported used the redesigned probe.

IM240 emission analysis was performed with three different types of gas analyzers. A flame ionization detector (FID) was used for HC, while CO and $CO_2$ analysis were each performed with a nondispersive infrared (NDIR) analyzer. Oxides of nitrogen (NOx, which includes both NO and $NO_2$) was measured using a chemiluminescense type analyzer. In contrast, the RG240 equipment in this study used a BAR 90 type NDIR gas analyzer for HC, CO, and $CO_2$. Also, for these development tests, NO measurements were performed with two different types of sensors, an electrochemical and a repair grade chemiluminescense. Both of these sensors measure only NO. The gas stream was divided and delivered to the sensors, which were mounted in parallel, so that each sensor would receive an unaltered emissions sample. Two different types of NO sensors were used in this program because no commercial RG240 NO sensors were available. The relatively new technology showed promise for this type of application. Production RG240 systems will have only one NO sensor.

The RG240 equipment system configuration in this conceptual evaluation used two IBM 80386 PC computers. One of the computers was used to control the dynamometer, and to display the RG240 driving schedule (which is the same as the IM240 driving schedule). The second computer was used as part of the BAR 90 gas analyzer system, which recorded emission concentrations as well as CVS inlet temperature and pressure. These values were then processed after the test to calculate emissions on a mass basis. Clearly, production RG240 systems will combine these functions into a single computer.

## DESCRIPTION OF TESTING

This testing program was performed by Automotive Testing Laboratories, Inc. (ATL) under contract to EPA at its Mesa, Arizona facility. A total of 19 vehicles were tested in this study, however, the new CVS probe design was used only on the last nine vehicles. These nine vehicles were a subset of vehicles recruited for on-going emission testing programs (a table containing vehicle information is contained in the appendix at the end of this paper). As part of these larger testing programs, repairs were also performed on vehicles with emissions exceeding 0.8 grams per mile (g/mi) for HC, 15.0 g/mi for CO, and 2.0 g/mi for NOx. In some cases, an RG240 and IM240 test were run after major repairs even though additional repairs were known to be needed to pass the IM240.

In order to compare emission results between the IM240 and the RG240 equipment systems, the goal was that every time a vehicle in the RG240 test program was tested using the IM240, it was tested in the same operating condition using the RG240. Because this was the first ever attempt at RG240 testing, with typical developmental issues, an RG240 test was not always performed for each IM240 test performed. In particular, RG240 NO data was not collected for the first few cars because the NO analyzers were not operational at that time. Occasional failures of the BAR 90 bench caused other vehicle test sequences to have incomplete before and after RG240 data.

## DATA ANALYSIS

In order to determine if the RG240 equipment system could determine

that adequate emissions reductions were achieved after repairs, it was useful to evaluate any correlation of the RG240 with the IM240. The correlative plots, Figures 2, 3, and 5, were plotted using both the before and after-repair data for HC, CO, and NOx (NO). Figure 4 is a comparison of the two RG240 NO sensors, which shows excellent agreement and linearity between the two different NO sensors. Because of this excellent agreement, only data from RG240 NO sensor number 1 will be used in this analysis, as the characteristics will also apply to RG240 NO sensor number 2. No analysis was performed for $CO_2$ because it is not a regulated emission.

Analysis of the RG240 versus IM240 data for HC (Figure 2) shows good correlation, but poor agreement in absolute magnitude of emissions between the two equipment systems. One area of concern is that the RG240 only measures about a third of the total hydrocarbon in comparison to the IM240, based on the slope of the equation for the linear fit line.

The under-reporting of HC by the RG240 is not surprising. Likely causes are the substantial differences in relative HC sensitivity in the NDIR used by the RG240 versus the more accurate FID used in the IM240, which has a better response to the many different hydrocarbon compounds present in motor vehicle exhaust. Also, the RG240 system may have a substantially slower response time than an IM240 system, and therefore this could possibly flatten the emission spikes.

A comparison in Figure 3 of results for CO shows reasonably good correlation of the RG240 to the IM240. The slope of the line indicates that the RG240 is measuring about half of the CO in relation to the IM240.

The differences between the RG240 and the IM240 in this case could also be due to the different response times of the RG240 and IM240 CO gas analyzers. Because instantaneous transient test emissions change rapidly, an analyzer with a slow response time may not measure the entire quantity of emissions present during a period of rapid emission change. Particularly when time correlating emission quantities with distance

**Figure 2**

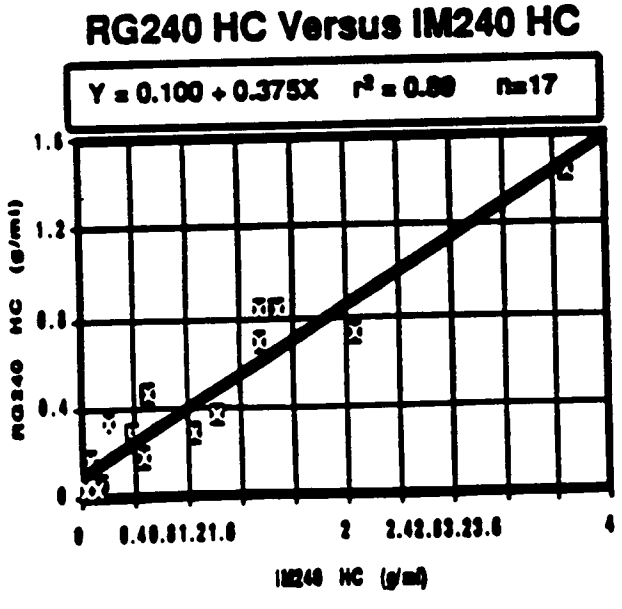
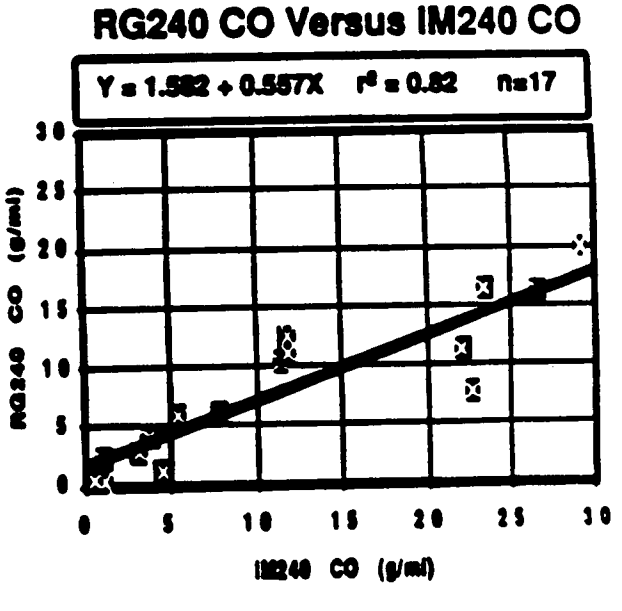



**Figure 3**

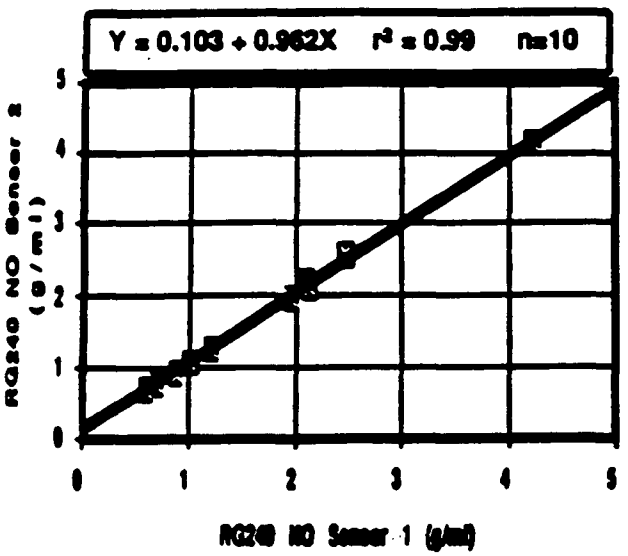


traveled on the driving cycle. While both tests use NDIR analyzers, the IM240 is a dedicated CO unit (with an optimized cell length) while the RG240 analyzer also measures HC and $CO_2$. Another cause for lower RG240 CO values may be under loading of the vehicle during acceleration portions of the RG240 due to the lower inertia weight in the RG240 dynamometer.

As discussed before, a comparison between the two different RG240 NO sensors (Figure 4) shows excellent correlation between the two NO sensors.

Figure 4

RG240 NO Sensor 1 Versus Sensor 2

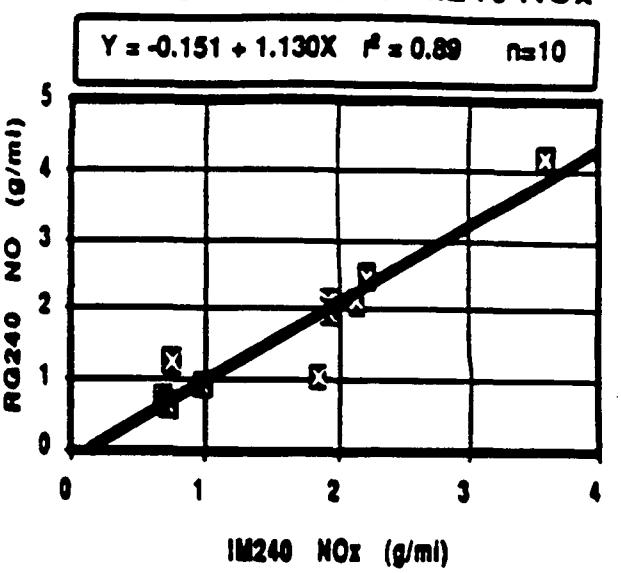



A comparison between RG240 NO and IM240 NOx (Figure 5) shows good correlation between the two. The linear fit line equation shows that the RG240 NO sensors are actually measuring slightly more NO than is measured by the more accurate IM240 NOx analyzer. This was a surprising result. One explanation for the high NO values recorded may be analyzer interference on the RG240 analyzer. Both RG240 NO analyzers follow the same trend of over measuring the quantity of NO.

A concern with the NOx correlation is that the inertia weight of the test vehicles used in this test

Figure 5

RG240 NO Versus IM240 NOx




program did not cover the range of inertia weights expected in an I/M program. In fact, almost all of the vehicles tested, by happenstance, had the same inertia weight of 3000 pounds. The testing of vehicles with different inertia weights to fully develop the relationship between the RG240 and the IM240 is important because NOx is generated under higher engine loads and its formation is dependent on the amount of inertia weight applied during a test. Future test programs will need to cover a broader range of vehicle inertia weights before the agreement between the RG240 and the IM240 in Figure 5 is considered to be fully valid.

Also, bear in mind, that this is a preliminary analysis of the RG240 with only nine vehicles tested. Additional testing with a wider variety of vehicles will likely affect the correlation between the IM240 and RG240.

## APPLYING THE RG240

While the RG240 on this small data sample does show an overall acceptable correlation for repairs with the IM240, the differing levels

at which the RG240 measures the emissions prevents directly using the RG240 results to predict whether a vehicle will pass on the official IM240 test when it returns to the official testing station. To assist repair shops in determining whether a repair was successful, a preliminary approach was developed. This involved creating a target value for the after-repair RG240 test that was calculated based on the percentage reduction needed from the initial IM240, and an initial RG240 test.

The following explains the calculations and procedures used in this preliminary approach to determine whether a repaired vehicle should be returned for a retest at the IM240 lane. Table 1 presents the IM240 and RG240 HC results, while Tables 2 and 3 present the CO and NOx (NO for RG240) results, respectively. Referring to Table 1, vehicle 911 fails the initial IM240 with HC emissions of 1.02 g/mi. Because the cutpoint is 0.8 g/mi, at least a 21.57% reduction is required for a passing score. The vehicle is then tested using the RG240 where the HC result was 0.36 g/mi. The 21.57% reduction is applied to this score resulting in a maximum target score of 0.28 g/mi for a RG240 retest. If after repairs were performed, the RG240 retest result

Table 1

IM240 and RG240 HC Results

| Veh Number | IM240 Run Number | Initial IM240 HC (g/mi) | Req % Reduction For Passing IM240 Score* | | Initial RG240 HC (g/mi) | | Target RG240 Score (Max) | [–After Repair–] RG240 (g/mi) | IM240 (g/mi) |
|---|---|---|---|---|---|---|---|---|---|
| 314 | 4934 | 0.47 | -70.21% | X | 0.17 | = | 0.29 | | |
| 911 | 4833 | 1.02 | 21.57% | X | 0.36 | = | 0.28 | | |
| 911 | 4957 | | | | | | | 0.07 | 0.07 |
| 912 | 4900 | 0.50 | -60.00% | X | 0.46 | = | 0.74 | | |
| 912 | 4939 | | | | | | | 0.28 | 0.39 |
| 912 | 4966 | | | | | | | 0.26 | 0.39 |
| 913 | 4890 | 1.48 | 45.95% | X | 0.83 | = | 0.45 | | |
| 916 | 5125 | 0.21 | -280.95% | X | 0.34 | = | 1.28 | | |
| 917 | 5122 | 0.85 | 5.88% | X | 0.29 | = | 0.27 | | |
| 917 | 5273 | | | | | | | 0.16 | 0.07 |
| 918 | 5117 | 0.14 | -471.43% | X | 0.06 | = | 0.35 | | |
| 918 | 5173 | | | | | | | 0.04 | 0.12 |
| 919 | 5141 | 3.70 | 78.38% | X | 1.44 | = | 0.31 | | |
| 919 | 5197 | | | | | | | 0.73 | 2.08 |
| 919 | 5258 | | | | | | | 0.04 | 0.03 |
| 920 | 5111 | 1.36 | 41.18% | X | 0.69 | = | 0.41 | | |
| 920 | 5111 | | | | | | Duplicate | 0.84 | 1.36 |

* IM240 Cutpoints of 0.8, 15, and 2.0 g/mi for HC, CO, and NOx.

was below 0.28 g/mi, and all other RG240 emission levels were below their RG240 targets, then the vehicle would be sent back for an IM240 retest. In this case, the vehicle was successfully repaired and therefore passed the retest.

This example is also illustrated graphically in Figure 6. Point number 1 is the initial (before repair) RG240/IM240 coordinate. Point number 2 is the target RG240/IM240 cutpoint coordinate. The IM240 percentage reduction is calculated based on the initial IM240 and the IM240 emission cutpoint. This percentage reduction is then applied to the initial RG240 value to determine the target RG240 value. If the vehicle had emissions below the target RG240 on the retest after repairs, then it would also be expected to be below the IM240 cutpoint.

It is important to recognize, in this preliminary approach, that the target RG240 value is the maximum score for the RG240 if the vehicle is expected to pass the IM240 retest. Technicians should be strongly encouraged to perform the required repairs so that the RG240 retest is significantly below the RG240 target value. This will result in cleaner air, and should provide additional assurance that a retest failure would not occur.

Table 2

IM240 and RG240 CO Results

| Veh Number | IM240 Run Number | Initial IM240 CO (g/mi) | Req % Reduction For Passing IM240 Score | | Initial RG240 CO (g/mi) | | Target RG240 Score (Max) | [–After Repair–] RG240 (g/mi) | IM240 (g/mi) |
|---|---|---|---|---|---|---|---|---|---|
| 314 | 4934 | 23.50 | 36.17% | X | 16.40 | = | 10.47 | | |
| 911 | 4833 | 7.80 | -92.31% | X | 5.99 | = | 11.51 | | |
| 911 | 4957 | | | | | | | 0.30 | 1.10 |
| 912 | 4900 | 22.10 | 32.13% | X | 11.27 | = | 7.65 | | |
| 912 | 4939 | | | | | | | 4.08 | 3.60 |
| 912 | 4966 | | | | | | | 5.93 | 5.40 |
| 913 | 4890 | 26.60 | 43.61% | X | 16.30 | = | 9.19 | | |
| 916 | 5125 | 3.80 | -294.74% | X | 4.05 | = | 15.98 | | |
| 917 | 5122 | 22.70 | 33.92% | X | 7.68 | = | 5.07 | | |
| 917 | 5273 | | | | | | | 2.31 | 1.00 |
| 918 | 5117 | 3.10 | -383.87% | X | 2.73 | = | 13.19 | | |
| 918 | 5173 | | | | | | | 1.23 | 4.50 |
| 919 | 5141 | 29.20 | 48.63% | X | 19.90 | = | 10.22 | | |
| 919 | 5197 | | | | | | | 10.31 | 11.40 |
| 919 | 5258 | | | | | | | 0.47 | 0.50 |
| 920 | 5111 | 11.80 | -27.12% | X | 11.14 | = | 14.16 | | |
| 920 | 5111 | | | | | | Duplicate | 12.53 | 11.80 |

Another example of a vehicle which failed its first RG240 retest and would therefore have been returned for additional repairs was vehicle number 919. This vehicle underwent two repair sequences and two IM240 retests before it was completely repaired. An examination of the target RG240 test values for HC in Table 1 and for NOx in Table 3 shows that not all of the repairs were completed, and additional repairs were needed.

Applying the same procedure to the CO values for vehicle 919 in Table 2 shows that the procedure indicated that the vehicle should be returned for additional repairs when the vehicle actually passed the IM240 retest for CO. However, it still failed the IM240 for HC and NOx on the retest. For this vehicle, the catalyst had been removed for the first retest after it was determined that the monolith catalyst was broken into pieces and blocking the exhaust, which resulted in high back pressure causing too much EGR. The increased EGR resulted in a misfire which caused the high HC. A test pipe had been installed in order to determine the emission levels of the engine-out exhaust. A new aftermarket catalyst was then installed and the vehicle was retested. This problem can be seen by inspecting the NO results in Table 3 for run number 5197. A large increase in the NOx levels occur when the testpipe was

Figure 6

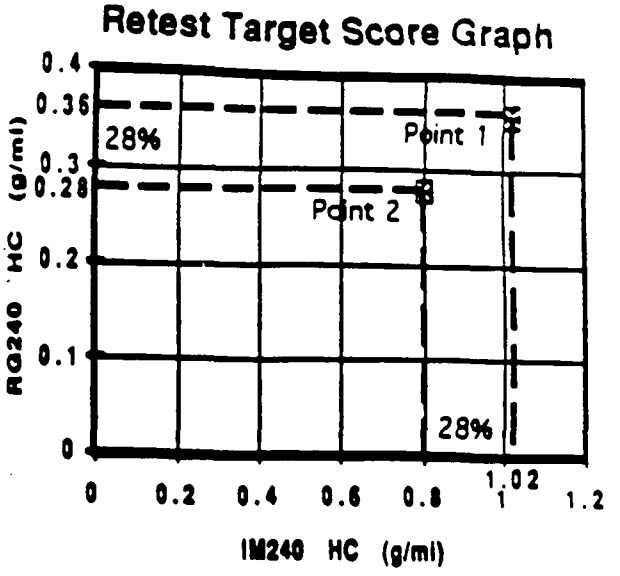



Table 3

IM240 NOx and RG240 NO Results

| Veh Number | IM240 Run Number | Initial IM240 NO (g/mi) | Req % Reduction For Passing IM240 Score | | Initial RG240 NO (g/mi) | | Target RG240 Score (Max) | [-After Repair-] RG240 (g/mi) | IM240 (g/mi) |
|---|---|---|---|---|---|---|---|---|---|
| 916 | 5125 | 0.75 | -166.67 | X | 1.22 | = | 2.10 | | |
| 917 | 5122 | 2.13 | 6.10 | X | 2.11 | = | 1.98 | | |
| 917 | 5273 | | | | | | | 0.9 | 0.98 |
| 918 | 5117 | 2.21 | 9.50 | X | 2.48 | = | 2.10 | | |
| 918 | 5173 | | | | | | | 0.7 | 0.68 |
| 919 | 5141 | 1.83 | -9.29 | X | 1.03 | = | 1.13 | | |
| 919 | 5197 | | | | | | | 4.22 | 3.59 |
| 919 | 5258 | | | | | | | 0.62 | 0.72 |
| 920 | 5111 | 1.91 | -4.71 | X | 2.13 | = | 2.10 | | |
| 920 | 5111 | | | | | | Duplicate | 1.96 | 1.91 |

installed.

While this example illustrates a situation where the vehicle would have passed the IM240 for CO, the RG240 identified that the vehicle was not correctly repaired and would not pass IM240 HC or NOx based on the results of the RG240. Part of the lack of specific differentiation in the calculation approach (i.e., procedure indicated that more CO repairs were needed for vehicle 919 when they were not) is possibly due to the preliminary nature of this calculation approach. However, the lack of precise differentiation is not inconsistent with the idea that the RG240 is a qualitative approach and not a quantitative one. Furthermore, an examination of the next IM240 retest shows that large additional decreases in emissions were available. Once again emphasizing the guidance that one should repair vehicles to as low a value on the RG240 as feasible.

Another repair situation which is addressed in the tables is determining how much emissions can increase. When performing improper or incomplete repairs on a transient test, it is not uncommon for NOx emissions to increase and CO emissions to decrease, or vice versa. This is especially true when the repair affects the air/fuel ratio of the vehicle. Carbon monoxide is formed when the air/fuel ratio is rich while NOx is formed under lean combustion conditions. Thus, if a vehicle fails for high CO due to a rich air/fuel ratio, it will probably also have very low NOx. After repairs are performed, an increase in NOx could occur if incomplete repairs are made.

In the case where the vehicle had a passing value on the initial IM240, the percent reduction calculated could be a negative value indicating that emissions could increase to the higher calculated target value. As long as all the emissions were below the target RG240 values after repairs, such increases would be acceptable. However, given the preliminary nature of this concept, it bears reiterating that mechanics would be advised to use extreme caution in situations where the initial IM240 and RG240 values are very small and a very high percentage increase in RG240 emissions is computed by this method. In such a case, the mechanic would be well advised to limit any increases in emissions to the minimum increases feasible.

In this preliminary method, the RG240 NO target score is capped at 2.1 g/mi due to the better overall agreement with the IM240 values. The 2.1 g/mi value was obtained by the using IM240 NOx cutpoint (2.0 g/mi) in the linear fit equation of Figure 5.

## CONCLUSIONS

The purpose of this test program was to determine if the RG240 concept could determine whether adequate emissions reductions had been achieved following repairs so that a vehicle would have a high assurance of passing an IM240 retest. This was a concept demonstration program, and a relatively small amount of data were collected; therefore, the results and conclusions may change with additional testing. However, the overall results were encouraging, and the initial expectations were met. Additional testing of the RG240 equipment systems is scheduled. Specific conclusions and observations from this test program are as follows.

1. An RG240 system was built which demonstrated an acceptable correlation with the IM240 emissions test for repair verification.

2. A preliminary method has been designed and demonstrated which allows the RG240 system to be used to determine if repairs have adequately reduced emissions from IM240 failing vehicles.

3. Due to compromises in the RG240 system design, the RG240 cannot determine the actual IM240 mass emissions of a vehicle.

4. Because of the qualitative nature of the RG240 emission levels, technicians using the RG240 should be encouraged to repair vehicles as low as feasible below the RG240 target score.

Additional studies of the RG240 program are scheduled. One of the primary focuses of these additional studies will be to test more vehicles in order to validate the results described in this paper. Emphasis will also be placed on evaluating the effect of RG240 enhancements such as inertia simulation using the dynamometer's power absorber, and evaluating the effect of different inertia weight vehicles. Mass emissions for HC, CO, and NOx at each second of the test will also be compared between the RG240 and IM240.

## ACKNOWLEDGEMENTS

Recognition is given to Mr. Dennis McClement and the staff at Automotive Testing Laboratories', Inc. Mesa, Arizona facility for their excellent work and insightful suggestions during the development of this program. A special thanks is given to Mr. Lennie Kocher for his help in fabricating the RG240 CVS at EPA's National Vehicle and Fuels Emissions Laboratory.

## REFERENCES

1. "Inspection/Maintenance Program Requirements", Federal Register, Vol 57 No. 215, 52950-53014, November 5, 1992.

2. Pidgeon, W., and Dobie, N. "IM240 Transient I/M Dynamometer Driving Schedule and the Composite I/M Test Procedure", Report No. EPA-AA-TSS-I/M-91-01, January, 1991.

3. "High-Tech I/M Test Procedures, Emissions standards, Quality Control Requirements, and Equipment Specifications", Revised Technical Guidance, Report No. EPA-AA-EPSD-IM-93-1, July, 1993.

## APPENDIX

Vehicle Description Table

| Vehicle Number. | Inertia Weight | Year | Mileage | Make | Model | Engine Disp. | Fuel System | Trans |
|---|---|---|---|---|---|---|---|---|
| 314 | 2500 | 89 | 69,006 | Honda | CRX | 1.5L | PFI | 5 spd |
| 911 | 3000 | 85 | 77,724 | Buick | Century | 2.5L | TBI | Auto |
| 912 | 3000 | 84 | 127,388 | Oldsmobile | Firenza | 1.8L | TBI | Auto |
| 913 | 3000 | 83 | 72,640 | Oldsmobile | Firenza | 1.8L | TBI | Auto |
| 916 | 3000 | 88 | 83,720 | Chevrolet | Corsica | 2.0L | TBI | Auto |
| 917 | 3000 | 88 | 69,158 | Honda | Prelude | 2.0L | PFI | Auto |
| 918 | 3000 | 86 | 82,547 | Toyota | Celica | 2.0L | PFI | Auto |
| 919 | 3000 | 84 | 126,750 | Buick | Skylark | 2.0L | TBI | 4spd |
| 920 | 3000 | 83 | 166,321 | Nissan | Maxima | 2.8L | PFI | Auto |

# APPENDIX 2

## Sample I/M Newsletters

BAR Report

Department of Consumer Affairs, Bureau of Automotive Repair Winter 1991

# Bills Recently Chaptered Into Law

Several bills that affect you and BAR were chaptered into law in 1990, and became effective 1/1/91. A summary of each bill is listed below:

**AB 2040, Chapter 1403 - BP 9882.14**

Reinstates BAR's participation in the Ignition Interlock program for driving offenses.

This program requires BAR to cooperate with the Office of Traffic Safety in adopting standards for the installation of the devices; requires BAR to designate and register stations that install devices; requires manufacturers to comply with installation standards; and allows BAR to charge manufacturers a fee to recover BAR's costs.

**AB 3242, Chapter 1207**

Adds automobile burglar alarms to the list of allowable installations without the BAR registration requirement, and places installation and repair of these alarms under Bureau of Electronic and Appliance Repair.

**SB 2330, Chapter 1453**

Requires the Air Resources Board to consult with BAR to adopt regulations which require owners and operators of heavy-duty diesel vehicles to perform regular inspections of vehicles for excessive emissions of smoke.

For more information about these bills, contact Kathy Runkle at (916) 855-7128.

**Inside RR**



# Special Considerations For ARDs Serving in Desert Storm Outlined

Auto repair dealers and mechanics/technicians on active duty in the Persian Gulf war may be able to reinstate their registrations or licenses without examination or penalty under certain conditions.

Section 114.5 of the Business and Professions Code defines and outlines the procedures to be followed during wartime, according to Michael A. Kelley, director of the California Department of Consumer Affairs.

Under the law, the conditions to reinstate include the following:

- registration or license must be valid at the time he/she entered the armed services;
- application for reinstatement must be made while the individual is serving in the armed services, or no later than one year from the date of discharge from active service or return to inactive military status;
- application is accompanied by an affidavit showing the date of entrance into the service, current status or date of discharge, and the renewal fee for the renewal period in which the application is filed.

The law further allows that if an application for reinstatement is filed more than one year after discharge or return to inactive status, BAR may require the technician to pass an examination.

However, technicians who practice their profession in California either part- or full-time while on active duty military status are required to maintain their licenses in good standing.

Licensees who receive treatment or are hospitalized in any veterans' facility, and are prevented from practicing their profession or vocation as a result, are excluded from the one-year period.

# Bakersfield Auto Shop Business Suspended

A Kern County automotive repair shop recently had its doors closed for 45 days in a crackdown by the Bureau of Automotive Repair (BAR).

D & G Automotive, located at 3909 Hughes Lane in Bakersfield, was prohibited from making repairs during the 45-day suspension because of violations of the Automotive Repair Act that included charging for parts that were not installed on vehicles on at least three different occasions.

The shop's owner, Douglas Mallory, was placed on five years' probation providing he obeys all laws and regulations. During the probation all replaced parts must be tagged and kept for inspection by BAR.

According to BAR officials, the investigation was launched after consumers said that the shop charged them for repairs not made and failed to provide estimates before work was performed.

# BAR Pledges Support For More Industry Training Opportunities

More training in the automotive field was the topic BAR Chief John P. Waraas addressed when the Automotive Service Council (ASC) convened last October in San Diego to celebrate its 50th anniversary.

Since the convention focused on trends to prepare members for tomorrow's marketplace, Waraas pledged BAR's support to develop training programs leading to professional certification and national standards of competence.

"Several organizations, including ASC, the Society of Automotive Engineers, the Environmental Protection Agency, and BAR are working together to develop a comprehensive program that would increase the level of technician training and provide the expertise necessary to deal with today's high-tech cars," Waraas said.

In his comments, Waraas also thanked ASC members for their support of BAR, particularly at last September's Clean Air Fairs, where members across California spent Saturdays providing informational emission tests for the public.

Waraas said the Smog Check program is now fully implemented, which was required by Senate Bill 1997. "BAR has established offices throughout the state in those areas that have not attained EPA standards for clean air, and we are well on our way to meeting our target of a 25 percent reduction in emissions by 1994," he added. "I appreciate the opportunity to meet with many of our colleagues and shop owners who have helped us greatly over the past year."

The theme of the event was "Yesterday, Today, and Tomorrow." "Yesterday" began for ASC in 1940 when a small group of Los Angeles shop owners got together after work to discuss issues that were to evolve into a code of ethics for 1700 member shops in California and 11,000 members nationwide today.

## No Increase Planned

# Smog Cert Fee To Remain $6

Some members of the auto repair industry are confused about recently passed legislation, SB 1874, (Presley, Chapter 1433, Statutes of 1990) which authorizes BAR to increase the certificate fee from the current $6 to $7 after Jan. 1, 1991.

"The fee for the smog certificate is still $6—this bill just gives us the authority to raise it," says Gary Hunter, Chief, Field Operations and Compliance Division. "So far, we have not determined that an increase is needed."

Prices for smog certificates are set by BAR regulations and are changed only after a public hearing process is completed and the Office of Administrative Law has approved the regulation. In any event, if an increase does occur, all Smog Check stations will be notified in advance.

# Two Firms Win BAR Public Awareness Bids

Two private public relations firms recently won bids to conduct public awareness programs on behalf of the Bureau of Automotive Repair (BAR).

Edleman Public Relations Worldwide won the statewide contract with a $1.7 million bid, and Johnson, Smith, Hobbs and McNally, a Sacramento advertising and public relations firm, will conduct public awareness campaigns for BAR in several northern California counties. The counties—Butte, Glenn, portions of San Bernardino and the remainder of Yolo and Solano—implemented the state's Smog Check program on March 1, 1991.

Hill and Knowlton, Inc., an international public relations firm, has been conducting public awareness programs for BAR since 1984. Edelman's Los Angeles office will handle the BAR account.

*Repair Reporter* is published twice a year by the California Department of Consumer Affairs, Bureau of Automotive Repair, 10240 Systems Parkway Sacramento, CA 95827 (916) 366-5100.

Editor: Kate McGuire
Staff writer: MaryAnne Newberry
Editorial asst./writer: Judy McClure
Graphics/writer: Marguerite Wobschall

Bureau of Automotive Repair
John P. Waraas, Chief
Douglas Leue, Deputy Chief
Gary Hunter, Chief Field Operations/Compliance Division
Amparo Garcia, Division Chief Administative & Technical Services
Kate McGuire, Public Information Officer

# Ford Plans To Fix 462,100 Vehicles

Ford Motor Co. recently announced that it has recalled about 457,000 of its 1986-88 model Aerostar minivans because of a potential windshield wiper problem.

The company also said it was recalling 5,100 of its 1988-90 F-Super Duty motorhome chassis to install a new brake-linkage rod to the brake pedal.

Ford said it was possible that the linkage could break, causing a loss of stopping ability. The company said it knows of no accidents linked to the problem.

The company is notifying all owners and will repair the problems free of charge.

# Alternative Fuel Fleet Helps Keep California Air Clean

While nations compete for a share of the earth's oil, California is fighting to control the pollution that comes from it.

Cleaner-burning fuel is one solution for improving the state's air quality, and manufacturers are experimenting with vehicles designed to burn alternative fuels. The question for manufacturers is, "Which comes first—new fuels such as methanol and ethanol, or the car that consumes them?"

At the Bureau of Automotive Repair (BAR), the flex-fuel car comes first. BAR maintains a fleet of 28 such vehicles, the largest of its kind in state government, said BAR Chief John Waraas, who has directed the use of alternative fuel cars by BAR statewide.

"Since we're in the clean air business, it makes sense to position ourselves on the leading edge of technology and set an example for California's motorists," said Kenji Okimoto, who monitors BAR's flex-fuel program.

Daily use of the still-rare vehicles requires special care, as well as a specially formulated engine oil to keep their engines running smoothly. Due to the corrosive nature of methanol, special spark plugs and fuel filters are also required. Do-it-yourselfers are out of luck at oil-change time, since these cars require special dealer maintenance. When inspecting vehicles manufactured to operate on methanol or a mixture of methanol and gasoline (flexible-fueled vehicles), technicians should refer to the underhood label to determine which emission controls are required.

In most respects, however, they operate the same as conventional cars do. Smog check inspections for methanol-powered vehicles, for example, are the same as for gasoline-powered vehicles.

Potential flex-fuel vehicle owners fear that fuel will be scarce. Potential fuel vendors fear that customers will be scarce. Only 18 service stations in California currently sell methanol, but concern for the environment should spur the eventual growth of such stations.

To encourage such growth the California Energy Commission promotes and coordinates the flex-fuel program statewide. A new handbook on alternative fuels will soon be available from the commission, and workshops will be held throughout California to familiarize fleet managers with the subject.

For more information about California Energy Commission's Alternative Fuels Program, contact the Transportation Technology Fuels Office at (916) 324-3527.

# New BAR Field Offices Open For Business

As more California counties join the Smog Check program, more BAR offices have been added from Redding to Rancho Mirage.

Offices opened recently in Merced, Auburn, Rancho Mirage, Canoga Park, San Luis Obispo, Modesto, Santa Barbara, Monterey, El Toro, Chico, Fairfield, and Apple Valley.

In addition to mediating consumer complaints, BAR personnel offer a variety of services to auto inspection and repair dealers.

Since most field office representatives worked in the automotive industry before joining BAR, they are able to provide technical help, as well as interpret laws and regulations.

Automobile repair shops may purchase lamp, brake, and smog certificates at the local offices, as well as pay licensing, registration, and training fees. Inspection and repair manuals and other BAR publications are also available, along with order blanks for requesting large quantities of publications from BAR's mailroom at headquarters.

All BAR offices provide services such as inspections for new lamp, brake or smog shops both prior to licensing and afterward. Training for Smog Check inspectors and testing for Smog Check mechanics and lamp and brake installers/adjusters is also performed in field office facilities.

BAR staff periodically hold workshops for auto industry groups to discuss a variety of topics, including existing regulations and new developments in the Smog Check program. Public information presentations for local organizations may also be arranged by contacting local field offices.

For more information about BAR field offices, call toll-free 1-800-952-5210.

## *DMV Smog Impact Fee Required Regardless of Smog Check Results*

**The $300 Department of Motor Vehicles (DMV) Smog Impact Fee is required for vehicles upon initial registration in California *regardless of whether the vehicle has received a smog certificate.***

**Vehicles affected are 1975 or newer gas, LPG, LNG, or methanol vehicles with an unladen weight of 6000 pounds or less, and 1980 or newer diesel-powered vehicles with an unladen weight of 6000 pounds or less.**

**The fee will be collected if the vehicle was registered outside the State of California immediately prior to application for registration, and it does not have a vehicle emissions control label indicating the vehicle is "California certified."**

# BAR Training Course Advisory Board Meets

Election of officers, the progress of implememtation of Senate Bill 1997 and continuing development of mechanic exams were among the topics of discussion at a Training Course Advisory Board meeting held Feb. 21, 1991, in Palm Desert.

The board holds four public meetings a year to keep up with rapidly advancing automotive technology. Automotive instructors are among the regular attendees who provide advice on changes needed in automotive training and testing programs.

Board members include Rich Branchini, Secretary, Bud Hennessy,V. Chair, Margaret Vineyard, Chair, Roy Okimoto and John Rogolino. All have automotive field backgrounds and volunteer their time to advise BAR on its mechanic training procedures and policies.

# Save Fuel, Clean the Air by Checking the Tires

It's hard to believe that something as simple as tire inflation can affect a vehicle's performance, but it can. Surveys show that the tires on more than half of the cars on the road are not inflated to manufacturers' specifications. Some adverse effects from improper inflation include poor handling, decreased fuel economy, increased tire wear and a significant increase in harmful emissions during highway travel.

Since tune-up or emissions work is not really complete without tire pressure service, take the time to check. Refer to the label on the vehicle door jamb, the owner's manual, or the guidebook(s) available to tire dealers.

Remind your customers of the effects and importance of proper tire inflation. Not only will your customer appreciate knowing that his or her tires are properly inflated, but you'll know one more vehicle is safer and running cleaner.

## Calendar

March 15-17—ASC North Conference, San Jose Convention Center

April 20—Earth Day, Gottschalks, Capitola

April 27-29—Time of Your Life Exposition, Los Angeles Convention Center

June 11-15—Shasta District Fair, Redding

June 28-29—ASC South Conference, Anaheim Convention Center

July 25-August 3—Stanislaus County Fair, Turlock

July 30-August 11—CA Mid-State Fair, Paso Robles

November 8—BAR Advisory Board Meeting, Location to be announced

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The WISCONSIN VEHICLE INSPECTION PROGRAM ANALYZER

VOLUME 1 PUBLISHED QUARTERLY BY THE DEPARTMENT OF TRANSPORTATION

# MECHANICS TEST PROCEDURE TO IMPROVE DIAGNOSIS

One of the most difficult recurring maintenance problems experienced by mechanics who are testing and repairing a vehicle that has failed the Vehicle Emissions Inspection Program, is trying to simulate the test procedure used in the test lanes.

The following Simulated Test Procedure has been devised through lengthy study by the Environmental Protection Agency and the Wisconsin Vehicle Emissions Inspection Program Staff.

### SIMULATED TEST PROCEDURE

1) Vehicle to be tested should be at normal operating temperature with all accessories off.
2) Analyzers should be warmed up, in stabilized operating condition, and adjusted properly.
3) With engine idling and transmission in neutral, insert probe into the tailpipe. Increase engine speed to 2,500 RPM for 30 seconds.
4) Reduce engine speed to free idle and record exhaust concentrations **20 seconds later.**

Although this test procedure is not an exact duplication of the emissions test, by using this test procedure, and adhering closely to the times indicated in steps #3 and #4, you will be able to simulate the test procedure much more accurately. Most repair facilities we have seen using this procedure with properly calibrated analyzers were able to repeatedly record test results very close to the results from the testing on the test station analyzer.

# HOW TO CURE A CARBURETOR PROBLEM

One of the most common reasons why a vehicle fails the state's new emissions test can be traced to the carburetor, where an improper mix of air and fuel can boost the amount of carbon monoxide or hydrocarbons emitted from the tailpipe. This condition can often be corrected through an adjustment of the air/fuel mixture while the engine is at curb idle speed.

To help insure that your customer's vehicle will more easily meet the state's emissions standards, perform at peak efficiency and yield optimum fuel economy, you should follow one of two procedures, depending on the initial vehicle emissions reading:

If the air/fuel mixture is too rich, causing a high carbon monoxide reading, there is too much fuel and not enough air present in the carburetor.

Step 1 – With analyzer connected, take CO readings and loosen air cleaner lid. If CO reading drops more than one percent, replace air filter and recheck readings.

Step 2 – Take an RPM reading. If engine RPM is below manufacturer's specifications, adjust the curb idle speed screw to bring the RPM to manufacturer's specs. This will open the throttle valve and allow more air to flow into the intake manifold.

Step 3 – Take another carbon monoxide reading with the RPM at manufacturer's specs. If this reading is still high, adjust the external air/fuel mixture screw, making sure you maintain proper RPM readings. If the vehicle has a sealed carburetor and is not covered under warranty, you should consult an appropriate service manual for instructions.

If the air/fuel mixture is too lean, causing a high hydrocarbon reading, there is too much air and not enough fuel present in the carburetor.

Step 1 – Take an RPM reading. If engine is above manufacturer's specifications, the curb idle speed screw should be adjusted to close the throttle valve, reducing air flow into the intake manifold.

Step 2 – Take another carbon monoxide reading. If this reading is still not at manufacturer's specs, the external air/fuel mixture screw should be adjusted while maintaining a proper RPM reading. If the vehicle has a sealed carburetor, not covered by warranty, consult an appropriate service manual for instructions.

# TRACKING VEHICLE "LOSS OF POWER"

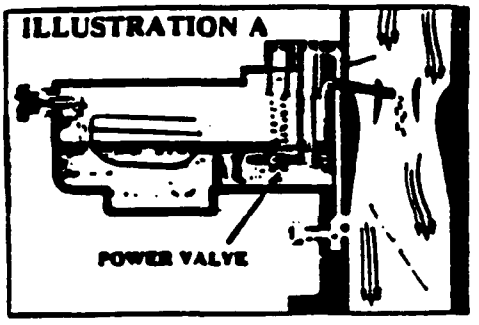
Excessive readings of either carbon monoxide or hydrocarbons during an emissions test can be a clear indication that the vehicle being tested is not performing at optimum levels.

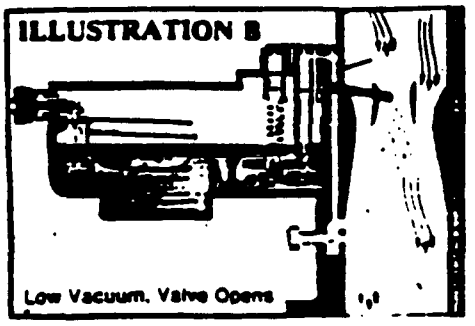
For example, one common complaint among motorists is "loss of power" when driving, which causes sluggish vehicle performance or stalling. This condition can result from the lack of adequate fuel flow to the carbruetor during periods of full throttle operation.

At full throttle, additional fuel is supplied to the engine by a carburetor power circuit, (see illustration A), which acts to increase the opening in the main fuel outlet from the fuel bowl. The circuit opens a valve in a separate power outlet, discharging gasoline into the main fuel system.

This valve action is controlled in one of two ways, depending on the vehicle. Either the intake manifold vacuum will operate the valve or the valve can be operated mechanically through the accelerator linkage.

At idle speed, the intake manifold vacuum is high but will decrease as the load on the engine increases. The vacuum is then used to overcome the force of a spring to hold the power valve closed. When the vacuum decreases to a set value, the spring forces open the valve, (see illustration B, below), and allows more gasoline to flow into the carburetor.




In the case of mechanically operated power circuits, gasoline flows into the carburetor by means of a stepped metering rod, which is raised in a jet of fixed size whenever the accelerator pedal is depressed. As the metering rod is raised up, the cross-section of the rod becomes smaller within the fixed jet and more gasoline will be allowed into the carburetor.

You can use your Emissions Analyzer to test a vehicle's power circuit, with no load, by following six easy steps:

1) Start the engine of the vehicle and allow the engine to reach normal operating temperature as determined by manufacturer's specifications; adjust mixture and curb idle speed to specifications.

2) Make sure your emissions analyzer is fully warmed up, and then zero and span check in accordance with the manufacturer's recommendations.

3) Place the exhaust test probe into the vehicle's tailpipe and clamp the RPM pick-up on the appropriate spark plug wire.

4) Note the carbon monoxide (CO) reading on the front panel of the analyzer while the engine is at curb idle speed.

5) Accelerate the engine gradually to 2000 rpm and allow the CO reading to stabilize. As rpm increases, the CO reading should increase dramatically. When the rpm stabilizes, the CO reading should be about one-half of what it read at curb idle and almost zero, if the car has a catalytic converter. If the readings stay higher than at idle, the power circuit is in operation all the time, or the carburetor float height may be too high.

6) Make sure that the parking brake is on and holding. Place the vehicle in gear with foot brake on. Accelerate engine with car in gear. CO will go up, then will drop slightly and should stay higher than at idle while under a load, and at low manifold vacuum. If this doesn't happen, the power circuit is not working properly or the carburetor float height may be too low.

## EMISSION WARRANTY COVERAGE FOR YOUR CUSTOMERS?

While most repair technicians know that such basic primary emission control parts as catalytic converters and air pumps are warranted by their vehicle manufacturer for the useful life of the vehicle, many are not aware that there are two separate emission warranties. Both the Emissions Defect Warranty and Emissions Performance Warranty were created by the Federal Clean Air Act and apply uniformly to all vehicle manufacturers, whether domestic or foreign. The warranties begin when the vehicle is first put into service, either as a demonstrator or at the time of retail sale, and are transferable to successive owners until the age or mileage limits are passed.

To be eligible for coverage under either warranty, owners are required to maintain their vehicles according to the manufacturer's maintenance schedules. These maintenance requirements can be performed by vehicle owners, private repair facilities, or manufacturers' representatives. In most cases, however, vehicles must be presented to a manufacturer's representative to have an emission warranty claim honored. This is to prevent the manufacturers from being held responsible for owner malmaintenance, misdiagnoses, or emission control system tampering.

The Emissions Defect Warranty applies nationwide for vehicles less than 5 years old with less than 50,000 miles. When an original engine part fails due to a defect in materials or workmanship, and the part failure causes the vehicle to exceed federal standards, the manufacturer must repair or replace the defective part free of charge, including labor and any miscellaneous items that are necessary to complete the repair.

The Emissions Performance Warranty applies only to 1981 or newer vehicles (with GVW less than 8,500 lbs.) that fail a federally approved emission test within geographic areas where emission inspection is required. It, too, is a 5 year or 50,000 mile warranty (whichever occurs first) but it has significantly different coverage dependent on the vehicle's age and mileage. During the first 2 years or 24,000 miles the manufacturer must make all repairs, replacements, or adjustments necessary to enable the vehicle to meet its required emission standards at no cost to the vehicle owner. After 2 years or 24,000 miles and up to 5 years or 50,000 miles, the manufacturer is responsible only for the repair, replacement, or adjustment of components which were installed in or on a vehicle for the sole or primary purpose of reducing vehicle emissions, and which were not in general use prior to model year 1968. All costs associated with a valid Emission Performance Warranty claim are covered by the vehicle manufacturer.

Due to constantly changing technology and variations in manufacturers terminology, it is difficult to list all covered primary emission control parts. Most parts that contribute to the closed loop operation of today's high tech vehicles are classified as primary parts. For clarification on these items or other emission warranty questions, call 778-3640 (Milwaukee) or toll free 1-800-242-7510 (outside Milwaukee).

## EMISSION CONTROL MAINTENANCE & ANALYZER OPERATIONS TRAINING

The area technical colleges are gearing up for the winter/spring semester with very fine vehicle emissions tune up and repair classes available to all vehicle service and repair mechanics.

The mechanics update course for the Wisconsin Vehicle Emissions Inspection Program provides insight into the requirements and goals of the Emissions Inspection Program, along with some excellent training with hands-on experience at calibrating, adjusting, and minor service of a variety of emissions analyzers.

The instructors are very knowledgeable and provide a good contact when dealing with that difficult problem in a vehicle that seems unresolvable. They are looking forward to your attending this class, are providing their name, phone number, and class status as listed below.

**Gateway Technical Institute**

**Instructors - Phil Atlas and Paul Sorenson**

A class will be offered February 18, 20, 25, 27. Each session will be four hours in length, 16 hours total class time.

A second class is tentatively planned for April 8, 10, 15, 17. The class will be offered if sufficient interest is shown.

*Continued on Back Page*

*Continued*

The instructors are asking each interested individual to send a short letter to:

Gateway Technical Institute
3520 - 30th Avenue
Kenosha, WI 53140
attn: Phil Atlas

In the letter please state whether you would prefer to attend the Racine, Kenosha, or Elkorn campus, and whether you want a day or night class.

**Milwaukee Area Technical College**
Instructor - Walter Metzelfeld
Phone # - (414) 278-6789

Mr. Metzelfeld requires a minimum of 12 students in each class, and will start up a new class each time sufficient interest is shown. All you need to do is give him a call and sign up!

**Moraine Park Technical Institute - West Bend**
Instructor - Glen Demoske
Phone # - (414) 929-2117 (Metro Line)

Here again the classes will begin just as soon as enough individuals sign up to take the course. The only requirement is to give Glen a call and let him know you're interested.

**Waukesha County Technical Institute**
Instructor - John Jewel
Phone # - (414) 691-5439

Mr. Jewel has just taken over as the program manager of the Automotive and Engine Department and is anxiously anticipating the startup of new classes. Just give him a call and sign up today!

# FOR MORE INFORMATION

Call 778-3640 (Milwaukee Metropolitan Area)
Or 1-800-242-7510 (toll free)
**Telephone Hours: 8:00 a.m.-4:30 p.m.**
**Monday-Friday**

Department of Transportation
Division of Motor Vehicles
MOTOR VEHICLE EMISSION
INSPECTION SECTION
1150 N. Alois
Milwaukee, WI 53208

# Implement Effective I&M With This Program Assistance Advisory from CSCV

As you probably know, EPA's final rule on vehicle I&M (Inspection & Maintenance) programs calls for each involved state to:

*" . . . regularly inform repair facilities of changes in the inspection program, training course schedules, common problems being found with particular engine families, diagnostic tips and the like."*

— Section 51.369(1) EPA Final Rule on I&M

To achieve this kind of information delivery, and to establish the required local dialog between those involved in the I (Inspection) and those involved in the M (Maintenance) components of the I&M program, CSCV will publish an 8-page quarterly newsletter designed to deliver exactly the kind of information described in Section 51.369(1) of the EPA's final rule. A sample of a typical issue, and its content, is contained in this Program Assistance Advisory Kit. We invite you to examine it and its opportunities, since we believe this quarterly update will be instrumental in assisting your state's I&M program to comply with Section 51.369(1) of EPA's final rule.

**CSCV**: The COALITION for SAFER, CLEANER VEHICLES is a national non-profit organization committed to assisting states in the adoption of effective emissions & safety inspection programs. The Coalition also provides public education on the benefits of vehicle inspection. Because of our broad membership, CSCV is uniquely positioned to serve as the vital communication link between the inspection program, industry hotline information providers, training providers, and the automotive repair industry

CSCV can make your state's fulfillment of EPA's Final Rule, Section 51.369(1) easy to accomplish by means of the

**CSCV I&M QUARTERLY UPDATE**

newsletter.

Based on discussions with EPA, this dialog for those involved in providing hi-tech I&M services, plus your own state-specific information, will meet the requirement in Section 51.369(1) of the final I&M rule. In addition to helping your state meet rule requirements, and improve the M (Maintenance) component of your I&M program, this newsletter will provide the bonus of important national diagnostic repair information and solutions to technical problems.

We would like to hear from you that the

**CSCV I&M QUARTERLY UPDATE**

newsletter will be part of your state's Enhanced or Basic I&M Program.

For complete details, please write to, or call:

CSCV, 321 D Street NE
Washington, DC 20002

Phone: 202 543 4499 Fax: 202 544 7865

As you will see, when you review this sample copy of **CSCV's I&M QUARTERLY UPDATE**, we will provide approved I&M technicians and approved I&M service shops with timely and important information on available training courses, frequent appearing and unusual repair problems, as well as the latest diagnostic service tips and information compiled from all the major national diagnostic hotlines.

Additionally, the **CSCV I&M QUARTERLY UPDATE** will serve as a vehicle for providing your own vital *state-specific* information on local training course schedules, changes in the inspection program and related topics to the repair industry, state air quality administrators, educators/trainers, inspection providers and all others who need to know.

This information will be essential in keeping all parties involved in the inspection and repair process for both Basic and Enhanced I&M programs, fully up-to-date.

The goal of the **CSCV I&M QUARTERLY UPDATE** will be to make I&M technician diagnosis and service performance as painless and troublefree as possible for vehicle owners everywhere.

This will not be a general consumer information newsletter . . . it is designed for, and intended to be read by, only those involved in providing hi-tech I&M services for your state's motoring public.

What approved I&M diagnostic/service technicians need, to be able to provide your state's motoring public with troublefree I&M services and complete satisfaction, is *DRIVEABILITY DIAGNOSTIC DATA*. We will provide this by publishing in every issue, a **Hi-Tech Hotline Help** section, from which real solutions will be provided to solve real I&M service problems. We will not re-publish or re-print car factory technical service bulletins, since these are now broadly available to most shops and technicians throughout the industry from a wide variety of sources. Our solutions will be unique and custom-generated from the hotline diagnosticians who respond to I&M/emissions/driveability problem service calls, many hundreds of times a day, every week and month of the year.

We will also keep the I&M service industry updated on training sessions available to them . . . and, as states provide the information to us, we will also cover new program details which may affect service shops and technicians who are expected to provide your state's motoring public with the right I&M diagnosis and service fix the first time.

If you believe your state can use the **CSCV I&M QUARTERLY UPDATE** newsletter as an effective part of its I&M Program implementation, we'd like to be your Section 51.369(1) information delivery system. CSCV can either:

**1]** Produce, print and mail to all involved and approved parties engaged in your state's I&M program, to any name & address list provided by you . . . or . . .

**2]** You may use the **CSCV I&M QUARTERLY UPDATE** newsletter as a delivery vehicle for your own specific state-oriented information. To do this we can:

**(a)** Provide you with bulk quantities of the printed newsletter, to which you may add your own supplemental information, for your own mail out . . . or . . .

**(b)** You may provide us with your own information: (i) either preprinted, or (ii) as camera-ready material, or (iii) as raw copy which we would typeset and print, and then insert your information into copies to be sent to your state's mailing list.

CSCV

# I&M QUARTERLY UPDATE

A periodic information service for all those involved in achieving cleaner air through Inspection & Maintenance of automotive exhaust & evaporative emission control systems

Published for the Coalition for Safer Cleaner Vehicles by Aftermarket Research Institute Inc

# I&M Rule Review: examining the regulatory impact

BY NO LATER than January 1, 1995, a majority of states *will* have to have taken serious steps toward cleaning up their air quality from excessively-polluting automobiles. Some 26 metro areas of the nation in 10 states which now have *no* I&M programs, must implement basic I&M (exhaust emission inspection & Maintenance) programs by Jan. 1, 1994. And, by Jan. 1, 1995, 83 other areas of the nation in 20 states plus DC, which have either basic or no I&M programs, but which still fail to meet the national ambient air quality standard—we call these non-attainment areas—must have in operation a more precise Enhanced I&M program designed around the brand-new and more comprehensive IM-240 inspection procedure.

It goes without saying that the new Enhanced I&M inspection procedure *will* be tighter and much more detailed than the earlier BAR 84 and BAR 90 standards used in almost all I&M programs now in place across the nation.

Despite better, cleaner-performing OE automotive exhaust emission systems on cars of the last five model years, continued and excessive levels of exhaust pollution from older cars are what is causing this new focus on tougher emission system diagnosis and adjustments. The goal is to identify thru inspection the gross polluters, have them brought back into compliance thru maintenance and repair, and then be re-tested to prove their clean-running performance.

With an eye on reducing vehicle-owner inconvenience, EPA will call for a maximum 4-minute test-cycle emission inspection. This has been named the IM-240 test since the equipment which will perform it has been designed to execute the emission check in no more than 240 seconds.

These new developments in the continuing battle to achieve cleaner air for all of us to breathe, will have major impacts on many shops, as well as on many thousands of professional automotive service technicians. States which must implement Enhanced I&M programs by 1/95, will call for IM-240 tests to be performed in test-only (no-repair) facilities. These test-only centers will feature loaded-mode (dynamometer) diagnosis. The results of such a test will be printed out and show in detail where in the 240-second time cycle a vehicle emits excessive levels of HC (hydrocarbons), CO (carbon monoxide) and NOx (oxides of nitrogen).

In addition, an evaporative purge check of each vehicle's fuel-vapor charcoal trap canister *will* be performed, a step which is not now part of any existing I&M check.

Repairs will not be available at test-only facilities. It will be up to the vehicle owner to choose the repair facility where emission repairs will be made. And, of course, a re-test of every vehicle which fails an initial

**continued on page 2**

## In this issue . . .

**This is a sample issue of what CSCV plans will be a regular 4-times-a-year newsletter for all those involved in achieving cleaner air through I&M of automotive exhaust & evaporative emission control systems.**



**Still basic, but still very important–a visual check can lead the technician to the seat of a problem. –Photo ASE**

## STATES ANNOUNCING ADOPTION OF CSCV TRAINING GUIDELINES

In-service technician training is expected to be a critical contributor to the success of I&M implementation. "If technicians are not educated to perform proper repairs," Gene D'Andrea, Chairman CSCV ETAB (Education Training Advisory Booard), told us recently, "the M side of I&M will not be able to reduce automotive-caused emissions as the EPA expects."

In an effort to ensure that I&M programs have the support and resources needed to succeed CSCV has formed:

- ETAB to develop training support guidelines for I&M programs: and
- NERC (Natl. Education Resource Center to provide information on integrated training programs, materials & support services to aid states in implementing I&M programs.

The good news is that a number of states now appear to be moving to embrace the CSCV Recommended Guidelines for In-service Technician Training. Programs developed in NY and FL meet the CSCV training model curriculum.

And we also understand that several other states may soon adopt the CSCV training program guidelines & or have included them in their RFPs (Request For Proposal).

## LOOKING FOR 60 MASTER TRAINERS TO TRAIN 600 MORE!

What it will take to crank up a train-the-trainers program for E:I&M (Enhanced I&M) technical implementation will be 60 master trainers. But not just any 60! "We are like the US Marine Corps," Gary Huggins, Exec. VP of CSCV stated in August. "We are looking for the 60 master trainers who are the cream of the national crop!" That will not be an easy task.

"The goal is to find a core group of 60 people who will be tasked to go out and train about 10 other trainers each," Huggins explained. The 600 group of hi-level industry and education based service trainers will be assigned, along with the initial 60, to train service technicians who could become approved or certified to perform E/I&M emission repair services in their states.

CSCV will set up a screening process which will make the determination as to the First 60 who will enter the E I&M Train-the-Trainers Program.

"We won't be able to accept everyone who applies for the First 60 Train-the-Trainers Program," Huggins admitted. "But for those may not be included in the first group, we hope to include many of them in the 600 Group which will take on the tough task of delivering E I&M training to technicians in those states which have been designated Enhanced I&M areas of the nation," he told us.

E I&M programs are expected to appear in 83 markets in 20 states plus DC by no later than Jan 1, 1995. See below on the page at right for these locations to find out if your automotive service shop is in a market which could be involved in offering E:I&M services to your automotive customers.

Automotive service technology trainers who would like to be part of either group, the First 60 or the 600 Group, contact Gary Huggins, at CSCV, 202-543-4499. Or write to:

**CSCV Train the Trainers**
321 D Street NE
Washington, DC 20002
Attn: Gary Huggins

## I&M RULE REVIEW (cont'd)

test will be required. This will mean the vehicle owner most likely will have to take the vehicle back to the test-only facility.

While it is not expected that shops will have to duplicate the sophisticated equipment used in an IM-240 check lane, certain investments in new equipment, or possibly in upgrades, will have to be assumed if a service shop intends to offer E/I&M repairs and bring back into compliance found-to-be-polluting vehicles. Also, some form of verification check in the service facility, after adjustments have been completed, will have to be done, if only to confirm to the vehicle owner that the vehicle will pass the re-test back at the inspection facility.

Technicians assigned to perform these new emission check services also will have to commit to undertaking update emission system (fuel/ignition/driveability) technical training. Technicians also may have to undertake a new level of ASE test certification beyond the existing A8 Engine Performance test, to prove they are capable of performing the work involved in Enhanced I&M correction.

ASE's new emission system diagnostician category of certification will be launched in the Spring '94 testing period. The new test will be offered at all test centers in the nation, ASE tells us.

We also understand that technicians who intend to register for the new ASE test next Spring must hold current A8 test certification status. ASE has also advised the industry that the new test will be completely diagnosis-oriented rather than repair-service slanted as are all their other categories of technician certification tests.

### New I&M Programs Coming to . . .

These 26 city-market areas must implement Basic I&M programs by Jan. 1, '94.

Akron, OH
Ann Arbor, MI
Aurora, IL
Beaumont, TX
Charleston, WV
Dayton, OH
Denton, TX
Durham, NC
Elgin, IL
Galveston, TX
Gastonia, NC
Grand Rapids, MI
Huntington, WV-Ashland, KY
Joliet, IL
Lewiston-Auburn, ME
Lewisville, TX
Muskegon-Muskegon Heights, MI
Parkersburg, WV-Marietta, OH
Petersburg-Colonial Heights, VA
Port Arthur, TX
Richmond, VA
Round Lake Beach, IL
Sheboygan, WI
Springfield, OH
Texas City-La Marque, TX
Toledo, OH

# Things to do BEFORE You Hit the Hotline Phone!

WHEN DIAGNOSTIC problems in the service bay can't be solved quickly, there's a great temptation to down-tools and call a hotline. But what many service technicians seem to ignore is the fact that a hotline diagnostician's time and expertise are at least as valuable as a caller's, maybe more so! So, calling a hotline before you have some basic facts at your fingertips, and some tests completed and recorded can be a serious waste of two people's valuable time.

Autoline Telediagnosis, St. Paul, MN, handles several hundred diagnostic phone calls per day. Stu Kidder is one of their top phone-call problem solvers. He told us: "Many callers forget that we can't see the vehicle they are working on, so it's important that their conversational dialogue be concise and accurate if we are to help them." For technician-callers this means you must have good vocal communications skills.

"Also," Kidder continued, "we need to know what tests have been done to check out the problem, specific electrical values if they are appropriate, and as much scope, scan tool and gas analyzer data as possible, assuming a caller has gathered all that data before they have called us."

Autoline's Customer Service Director, Rob Schuyt, suggests that most hotline diagnosticians should know which set of service manuals the calling technician is in the habit of using. "It helps to know if they use Mitchell, Chilton's or Motors Manuals, so we can check the source they are using. Here at Autoline we prefer to use the original official OE carmaker service data since we often find it to be more completely detailed than some of the edited manuals," Schuyt stated.

As with any service procedure, most diagnosticians we talked to suggest that an initial thorough visual check be done before using a tool or connecting a test meter.

Joe Marchesani, a GM Tech Specialist diagnostician at ASPIRE, Morrisville, PA, told us: "The visual check is important because it can show earlier work that may have been done. This can be a good clue in locating the initial problem area. It may also help to track down and provide a cure quickly." But ASPIRE's Director of Diagnostic Services, J. R. King stated: "So many shrouds and covers are to be found under the hood today, that visual problems may not spring into view that easily." He does agree, however, that before anything else is done, the visual check is still important to do.

Now, before you call that hotline help, be sure you have:

1) Paper & pencil to take notes on diagnostic guidance given to you.
2) The year/make/model of vehicle, as well as engine size, fuel system type, and other data which will help the diagnostician lock on to problem causes.
3) Performed a visual check of the engine and problem system.
4) Taken preliminary test readings and notes on values found.
5) The ability to deliver clear and concise descriptions of the problem system and the data taken.

Remember, it's not just the cost of a hotline phone-call, but it's your time too, as well as that of the diagnostician you are calling for help!

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## Enhanced I&M Programs Coming to ...

The following 83 city/metro-market areas must implement IM-240 Enhanced I&M programs by by no later than January 1, 1995.

Albany-Schenectady-Troy, NY
Allentown-Bethlehem, PA
Altoona, PA
Atlanta, GA
Attleboro, MA & Providence, RI
Atlantic City, NJ
Bakersfield, CA
Baltimore, MD
Baton Rouge, LA
Bergen-Passaic Counties, NJ
Binghamton, NY
Boston, MA
Bridgeport-Milford, CT
Brockton, MA
Buffalo, NY
Burlington, VT
Chicago, IL
Danbury, CT
Denver, CO
El Paso, TX
Erie, PA
Fall River, MA
Fitchburg-Leominster, MA
Fresno, CA
Glens Falls, NY
Hagerstown, MD
Harrisburg-Lebanon-Carlisle, PA
Hartford, CT
Houston, TX
Jamestown-Dunkirk, NY
Jersey City, NJ
Johnstown, PA
Lancaster, PA
Las Vegas, NV
Lawrence-Haverhill, MA
Los Angeles-Long Beach, CA
Lowell, MA
Manchester, NH
Middlesex-Somerset-Hunterdon, NJ
Milwaukee, WI
Monmouth-Ocean Counties, NJ
Nashua, NH
Nassau-Suffolk Counties, NY
Newark, NJ
New Bedford, MA
New Britain, CT
New Haven-Meriden, CT
New London-Norwich, CT
New York, NY
Niagara Falls, NY
Norwalk, CT
Orange County, NY
Oxnard-Ventura-Thousand Oaks, CA
Pawtucket-Woonsocket, RI
Philadelphia, PA
Pittsburgh, PA
Portland, ME
Portsmouth-Dover-Rochester, NH
Poughkeepsie, NY
Reading, PA
Rochester, NY
Sacramento, CA
Salem-Gloucester, MA
San Bernardino-Riverside, CA
San Diego, CA
Scranton-Wilkes-Barre, PA
Seattle-Everett, WA
Sharon, PA
Spokane, WA
Springfield, MA
Stamford, CT
State College, PA
Syracuse, NY
Tacoma, WA
Trenton, NJ
Utica-Rome, NY
Vineland-Millville-Bridgeton, NJ
Washington, DC
Waterbury, CT
Williamsport, PA
Wilmington, DE
Worcester, MA . . . & . . . York, PA

## HI-TECH HOTLINE HELP . . .

# A Digest of Calls Made to the Indust

## AUDI

### NO-SPARK AFTER REPAIRS ON '84-'85 5000 TURBO

*From Mitchell On-Call Telediagnostics*

If a no-spark condition shows up after routine repair work on the 5000 Turbo, check to see if the distributor was either removed or adjusted. Audi has an incredibly finicky ignition system. A no-spark condition will result if the distributor is even a few degrees off its factory setting.

Install a spark tester in one of the plug wires. Now loosen the distributor hold-down. Crank the engine while SLOWLY turning the distributor either way. If spark returns, the distributor is now in the correct position. Tighten down in that exact position in order to achieve the repair.

Here's what happens. This ignition system uses three engine-speed sensors. The first is the speed sensor, a non-adjustable magnetic pickup which produces 135 impulses per CRANKSHAFT revolution, via 135 teeth on the flywheel. These impulses are used as the primary input to determine engine speed and the ignition timing point. This sensor is located on the upper left side of the transmission bell housing.

The second sensor is called the reference sensor, also a non-adjustable magnetic pickup which produces 1 impulse per CRANKSHAFT revolution at 60° BTDC, via a pin inserted in the flywheel. It is used by the control unit, along with the Hall sensor in the distributor, to identify TDC for the #1 cylinder. This sensor is located next to the speed sensor.

The third sensor is called the Hall sending unit, a Hall effect which produces one broad signal per DISTRIBUTOR SHAFT rotation just before ignition on TDC #1 cylinder. This is needed because the reference sensor creates an impulse 60° before TDC on the compression stroke, and also on the exhaust stroke.

The control unit is only interested in the compression-stroke impulse, however. The Hall sending unit serves to identify and validate the reference sensor compression impulse, since it rotates at half the speed of the crankshaft. If the Hall sending unit sensor is out of sync the reference sensor will not get validated, and the ignition and fuel systems will not become energized.

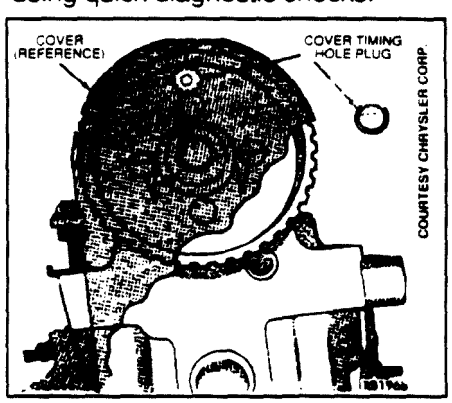
## CHRYSLER CORP.

### CHRYSLER 2.2/2.5 & TURBO PERFORMANCE GRIPES

***from the ASPIRE Telediagnostic Hotline***

Some owners of Chrysler vehicles with the 2.2L, the 2.5L, and turbocharged versions of these power plants, may complain about poor performance, lack of power and a rich-running condition. When diagnosing for these problems most technicians know the usual causes of these driveability gripes, such as the MAP sensor, or checking for injector update bulletins.

Along with these common problems, Aspire diagnosticians have noted that some timing belts have jumped, or been installed improperly, and are out of time. Incorrect cam-timing changes valve timing in relationship to piston position. This results in low engine vacuum, which affects MAP sensor voltage output. Unfortunately, the incorrect MAP sensor voltage may lead some technicians to overlook the timing belt as a cause, especially when doing quick diagnostic checks.




Aspire recommends the following quick method of checking timing belt alignment, by the use of an inductive timing light with a built-in advance meter. Follow this procedure:

1) Gearshift selector should be PARK.
2) Engine should be running.
3) Inductive timing light should be hooked up to cyl. # 1.
4) View the ignition timing mark; now, using the advance meter on the timing light, dial it back to read 0°, or TDC (top dead *center*).
5) Remove the rubber plug on the timing belt cover, and view the pointer on the cam gear thru the hole with the timing light.
6) It should be close to the 12 o'clock position. If it is not, the timing belt may be off by one tooth. In this case the timing belt cover will have to be removed for a closer check.

## FORD LINCOLN-MERCURY

### HIGH CO & ABOVE-NORMAL HC ON FORD VEHICLES

***From Autoline Telediagnostics***

Poor fuel economy and driveability performance may be a complaint related to almost any Ford vehicle from 1985 to present. Any vehicle with this complaint may or may not have fault code 41 set in continuous memory. These vehicles, however, may pass a KOEO (key on, engine off) test, so further diagnosis is called for.

We recommend that the technician test the voltage output of the EGO (oxygen) sensor(s). If sensor output is low, the ECA usually tends to think the vehicle is running too lean. It will then attempt to cure this condition by commanding an increase in fuel delivery.

Normally, the EGO sensor should have a rapidly fluctuating voltage value, between 100 and 900 mv. If the sensor tends to stay low, in the 200 to 400 mv range, induce some propane into the intake manifold.

This procedure should see sensor voltage rise immediately to 900 mv, or more. If the mv rise is not found, it's time to replace the EGO sensor.

# 's Troubleshooting Diagnostic Services

## BRONCO II 2.9L ROUGH IDLE AND EMISSIONS PROBLEMS

*From Autoline Telediagnostics*

The caller on this 1986 Ford Bronco problem had 6% CO 600 HC ppm and a burned oxygen sensor wire. The engine also was flooding. After installation of a new oxygen sensor, the KOEO self-test showed fault codes 11, 10, 65.

The key on engine running self test showed code 33, but the fuel pressure was unknown. CO 6% condition remained, so we advised a fuel pump pressure check.

This was done and showed 30-40 psi. The technician caller also revealed that he had found the throttle body assembly and bypass valve were in bad condition. We advised him to clean the TB assembly.

After doing this the air bypass valve was reset to hard stop (minimum idle) specs. The ECA also was retrained, and we recommended an injector pulse-width measurement at hot idle. This check showed that pulse width was 1.2 mS. A check of the MAP sensor inputs found the sensor frequency was too low at idle. The MAP sensor needed replacement.

## MERCURY TOPAZ 2.3L 4-CYL. ENGINE IGNITION PROBLEM

*From Autoline Telediagnostics*

The caller with an apparent ignition malfunction problem on a 1986 Mercury Topaz told us he had installed a new stator, a TFI module and a known-good coil. Nothing seemed to work. There continued to be no spark, even with SPOUT disconnected. He could not obtain an injector pulse either.

We suggested a check of the voltage readings at the TFI module connector. These proved to be OK, except that the PIP wire read .7v. Next we suggested he check for a PIP signal from the stator. When he did this he reported the signal went from 0v to 5v. The same reading showed with the processor disconnected.

Once the PIP wire was clipped near the distributor a normal PIP signal was obtained, as well as spark. The cause of this non-ignition problem call was a short in the PIP wire.

## 1987 MUSTANG 4-CYL. 2.3 EFI WET PLUGS

*From Autoline Telediagnostics*

The problem with this vehicle was that after driving and being shut off, the car would apparently flood and blow black smoke. A check of the fuel system showed 35 psi. Once started, the owner reported that the engine ran fine, after clearing out the smoke.

We recommended that the fuel pressure dropoff rate be checked, and that if it dropped off quickly that the technician should pull the injectors to check and test them. He did this and found that there was no leakage.

Next we advised a check of the vacuum line to the fuel pressure regulator for sign of fuel in the hose. This check confirmed there was fuel in the line and that a very wet external condition existed. What was bad was the pressure regulator, and replacement eliminated this complaint.

## 3.8L V6 TAURUS FAULTY PFE BACKPRESSURE SENSOR

*From Autoline Telediagnostics*

This caller advised us that he had found the back pressure sensor was all burned up. We suggested there may be a restricted exhaust system, and that if found to be plugged to check for any possible intake manifold gasket problems. Under plugged conditions the PFE sensor will get hot when the exhaust is restricted in any way.

## GENERAL MOTORS

## GM 2.8L CARBURETED V6 LIGHT ACCELERATION CURE

*From Autoline Telediagnostics*

Many technicians have had problems in trying to cure rough idle and poor performance at light throttle acceleration in 1981-86 GM X and A-body vehicles with the 2.8L V6 E2SE carburetor engine. M/C (mixture control) dwell may be found to be low, possibly stuck at 6 degrees. Cruise-speed emissions also may be affected and out of compliance.

Check the M/C solenoid for a possible broken tip. If found to be bad, you should replace this item with an update. Be sure to refer to the specific part number. This may differ depending on the car line vehicle in which this engine is installed.

Adjust the M/C dwell at the idle mixture screw, and, if necessary, adjust dwell to approximately 30°, using the lean authority screw.

## 1985-1989 FI 3.8L V6 NO-START CONDITION

*From the ASPIRE Telediagnostic Hotline*

Front drive cars equipped with 3.8L fuel injected engines (VIN code #3 or B, years 1985-1989) will sometimes exhibit a no start condition. These vehicles will have spark, injector pulse, and fuel pressure. When the engine is cranked, it sounds like it is out of time. In many instances, the cause of this condition is late or jumped valve timing.

Diagnosis of this condition can best be accomplished by removing the right front wheel and splash shield and working through the wheel opening. Remove the cam sensor out of the front cover. Shine a light in the hole and observe the movement of the cam gear, while working the crankshaft pulley back and forth with a breaker bar and socket. If the crank must be moved excessively before cam gear movement is observed, both gears and chain are bad.

When replacing the cam gear, a factory-type aluminum gear should be used. An iron replacement gear may affect the magnetism of the interrupter and can cause a no start, due to the lack of a cam sensor signal.

On 1985-1987, 3.0 litre and 3.8 liters, it is also advisable to replace the spring and button that keeps the cam loaded up toward the rear of the engine, with a later style, heavier spring and bearing assembly (P/N 25532588).

It should also be noted, 3.0 and 3.8 litre, 90° Buick manufactured V-6s, can sometimes be valve benders. When pricing a gear and chain replacement, it would be advisable to consider the likelihood of bent valves.

## MISFIRING GM QUAD 4 2.3L ENGINES

***From Autoline Telediagnostics***

Complaints with the GM Quad 4 2.3L engine installed in GM N body vehicles may be described as constant misfires, and showing high HC levels. These conditions may be due to several different causes, but most usually relate to the secondary ignition system.

GM had a fix campaign some time ago on faulty ignition coils. When checking to see if updated ignition coils have been installed, be sure to look for a yellow insert at the connector.

If the problem is not due to faulty ignition coils, or if the correct coils have been installed, yet the problem continues, you should check for spark at each coil pair. Do this by use of test plug wires and HEI spark testers. Both testers should have spark. However, if only one tester shows a spark, the coil housing is at fault.

## GM SMALL-BLOCK ENGINES STALLING AT LOW RPMS

***from the ASPIRE Telediagnostic Hotline***

Some small-block V8 Chevrolet-powered cars and trucks —either carbureted or fuel injected—may sometimes stall at low engine rpms, or stall when put into gear. Aspire diagnostic technicians have found, in some instances, that this condition is caused by a weak signal from the distributor pole piece.

What happens is that the timer core on the distributor mainshaft usually will be found to have lost some of its original magnetization on vehicles with this chronic type of problem. The timer core magnet on vehicles with this complaint will be too weak to provide an adequate signal, especially at low engine rpms. Replacement of the distributor mainshaft will prove to be a successful fix for this annoying complaint.

This will be found particularly on 1987 and up Chevrolet light-duty trucks, and RWD vehicles such as the Monte Carlo, Caprice and Camaro/Firebird. Vehicles with distributor P/N 1103698 have been covered in a technical bulletin concerning oil getting into the distributor. The recommended fix in that bulletin was to replace the distributor mainshaft with P/N 11046753. We recommend that that updated distributor mainshaft P/N be used.

## HONDA

## HIGH HC IDLE EMISSIONS ON HONDA CVCC ENGINES

***From Autoline Telediagnostics***

This complaint may be expressed as one of uneven or rough idle performance on some Honda CVCC engines. High HC idle also may be detected thru exhaust-gas diagnosis. Technicians should be aware that only the correct manufacturer-recommended spark plugs should be used in a CVCC engine with this complaint.

Spark plugs which do not meet Honda specs for heat range and electrode dimensions may cause a misfire condition. Due to the particular design of the Honda CVCC combustion chamber, it is recommended that only the correct Honda spark plug application be followed.

Be particularly careful not to use extended-reach plugs in any CVCC engine application.

## HONDA ACCORD COLD START PROBLEM

***From Autoline Telediagnostics***

We recently had a call on a 1985 Honda Accord whose owner had experienced chronic cold start problems in the morning. The engine needed constant choking to keep it running. The cold-start condition, the owner told our caller, also included the engine dying several times before it finally would run.

We first advised a check for a leaking carburetor insulator and suggested a propane enrichment test of the idle mixture. After adjustment our caller still had a problem since the vehicle would stall almost as soon as it had been started.

The technician found that vacuum hose 17 was plugged. Once cleared the engine still stalled. We advised that he should remove the stopper from the main fuel cut solenoid, and to flush the auxiliary idle circuit. We also suggested that an adjustment may be needed on the lambda screw if the fuel mixture could not be enriched sufficiently for the engine to run steadily. But there also was the possibility that there was an air control leak.

The calling technician found that the fuel cut solenoid was the cause of this problem, and by removing the stopper the problem was cured.

## ERRATIC IDLE SPEED ON CRX DUAL-STAGE TBI

***From Mitchell On-Call Telediagnostics***

If this type engine in a CRX jumps intermittently from idle speed to 2500-3000 rpm, and then back to normal after 1 to 20 secs., suspect a faulty TW sensor. TW is Honda terminology for a coolant sensor. The sensor can fail intermittently, almost as if it burps.

Diagnose by monitoring the connected TW sensor signal line during the symptom. If the sensor is responsible, it will quickly bounce from its normal 0.5v or so when hot, to approximately 4.6v during the symptom. It may do all this without setting a code.

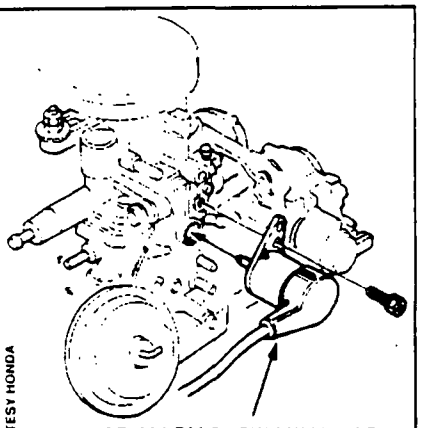
## CARB ENGINE FAST-IDLE COMPLAINTS POST TUNE-UP

***from the ASPIRE Telediagnostic Hotline***

Honda Motor Corporation produced and sold many vehicles with carburetor systems. Aspire receives a number of calls on these vehicles with a customer complaint of idling

too fast, however, the technician cannot lower the idle to normal specifications. The engine will continue to run, if the idle speed is set around 1000 to 1200 RPM or more. If an attempt to lower the idle is made, the engine stalls or dies out. Naturally, the higher idle has many negative effects: poor gas mileage, high emissions levels, harsh auto-trans engagement, etc.

If the carburetor is equipped with an idle cut off solenoid, Aspire recommends checking its operation. The solenoid's function is to cut off the idle circuit passage way. It is used in a number of ways on many different models to prevent dieseling or post ignition. As a de-cel solenoid, it is used to prevent high exhaust emissions and backfiring on deceleration.



COURTESY HONDA

**PRIMARY SLOW MIXTURE CUT-OFF SOLENOID VALVE**

Some solenoids use a single electric wire feed of 12 volts for activation. Usually the 12 volts is supplied by the ignition switch. Others have two wires, a 12 volt feed wire, again from the ignition circuit, and a second wire which the feedback computer would ground to control the solenoid operation. All solenoids can be checked on or off the car, by looking for a mechanical operation, while 12 volts and a ground are supplied.

The solenoid is called by various names; idle cut off solenoid, de-cel solenoid, primary slow mixture cut off solenoid, fuel cut off solenoid, etc. Its function is to cut off the idle circuit passage way.



## MAZDA

### RX7 FUEL FLOODING & NO-START CONDITIONS

*from the ASPIRE Telediagnostic Hotline*

We receive some calls on the rotary-powered Mazda RX7 sports car. Many of these focus on a fuel-flooding condition, particularly in cold weather. Most technicians we talk to start their diagnosis by looking for codes, or by checking for faulty sensors which also may cause a flooding condition.

Usually, after all their checks, including a fuel pressure test, they fail to find the cause of this problem. We have found that in the great majority of cases there is nothing wrong with either the fuel pressure levels, the ECU, or its sensors.

The real cause of this problem usually may be excessive voltage drop in the starter circuit, a battery problem (defective, undersized, or in a low state of charge) or a defective starter. This engine demands high-cranking rpm. If the engine spins too slowly for the amount of fuel being injected, the plugs will foul, leading to a no-start condition.

## NISSAN

### POOR RUNNING ON NAPS DUAL IGNITION ENGINES

***From Mitchell On-Call Telediagnostics***

Two of Nissan's engine families, the Z series and the 2-valve CA series, are equipped with the dual-ignition NAPS (Nissan Anti Pollution-control System) setup. NAPS may be found either as standard or optional equipment, on the following models: 1981 510; 1981-88 200SX; 1981-89 720 Pickup truck; 1982 and 1983.5-89 Stanza; 1986-89 Station wagon; 1987-89 Pathfinder; 1987-90 Van; 1987-89 Pulsar NX.

A problem with the NAPS ignition system can create rough idle, idle stall, decel stall, poor acceleration, or surge at cruise speed. Most of these symptoms may be inadvertently created by faulty repair work.

The NAPS dual-ignition system has two spark plugs per cylinder and two ignition coils to fire them. A spark plug switching system was introduced on all versions in 1982. This modification prevents detonation caused by two flame fronts colliding. During heavy load operation, the exhaust side spark plugs are shut off to eliminate one flame front. Engine load is determined by either the fuel injection control unit, or a simple vacuum switch. On 1981 models, both sets of plugs are always ON.

The most common fault is spark plug installation. The exhaust-side plugs are different from the intake-side plugs, regardless of model year. Any of the poor-running symptoms described above will result if the plugs are switched, mixed, or of all the same type. So be sure to check the recommended plug specs.

The second most common fault occurs when the intake-side coil fires the exhaust-side plugs, and/or vice versa. This happens because the plug wires or coil wires are routed incorrectly. A severe hesitation will result when the INTAKE plugs are shut down during heavy load. Two test methods are available to determine if the coils are firing the wrong set of plugs.

(1) Later-model vehicles use a 4-wire connector on the intake coil, and a 3-wire connector on the exhaust coil. Use the connector to identify the coil, then visually follow the plug wires to verify the correct set of plugs being supplied.

(2) A timing light may be used on the intake side. Rev the engine under load. If the light stops flashing, the wires are routed incorrectly. Remember that 1981 versions of NAPS will not suffer from switched coils, since on '81 NAPS engines all plugs always fire.

Another wire routing error happens when the firing order is set incorrectly. Many of these engines have separate firing orders for the intake (1-3-2-4) and exhaust (1-3-4-2). The difference is due to the limitations of using the same distributor cap and rotor to handle both coil sets, and not because the engine actually has two different firing orders.

The last most common fault on a NAPS engine occurs when one set of plugs does not fire. This fast creates a severe rough idle, stalling, and terrible acceleration. Use a timing light or spark tester on both sides to diagnose this fault. The usual culprit is either a faulty ignition module, or a faulty power transistor.

One final caution. If detonation under load occurs, verify that the exhaust plugs are shutting off as they should.

## VARIETY OF PROBLEMS ON NISSAN E16S ENGINES

***From Mitchell On-Call Telediagnostics***

This engine is used on 1983-87 Sentra models, and on 1983-87 Pulsar models.

If the air cleaner fills with oil, be sure to check the PCV hose. It may become soft and tend to suck shut, usually under moderate load, right past the step-down in the hose as it passes through the intake runners. This is an area of the hose where its diameter decreases. Another symptom might be that the idle CO percentage will increase if the hose is always collapsed.

On the chokeless Hitachi carb, used exclusively from 1984-87, but not in 1983, the bakelite insulator may be cracked. This may cause one of the two strands going to the mixture control solenoid to intermittently open the circuit, driving the carb to full-rich. This mixture-control solenoid works identically to a GM design: the carb will run full-rich when off, and full-lean when 100% energized.

A no-start, no-spark condition is likely to be due to a bad connection at the ECC main relay. This unit is located on the fenderwell. The connections under the relay are exposed to road splash, and usually suffer corrosion deterioration. A failure on this circuit will not supply the ECU with needed power, depriving the optical distributor of the power it needs to function.

# TOYOTA

## BLACK SMOKE ON 22R NON-FEEDBACK ENGINE

***From Mitchell On-Call Telediagnostics***

If this pickup truck engine always runs rich, showing black smoke, though not smoking as badly when it is warm, the power valve is a likely culprit. The valve's spring tension weakens over time, thus allowing it to open too early.

First, verify the jets are not leaking and the float level observed thru the window is OK. If both check OK, open up the carb and test the power valve. This is a regular floor-jet type. Now remove it from the bottom of the float bowl and install a hand held vacuum pump to the threaded portion of the valve. A good power valve will open at or above 3 ins. A bad one will open around 1 in.

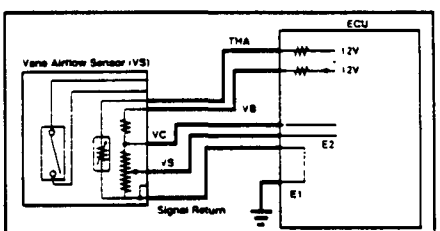
This carb has a temperature-compensated spring accelerator pump. If it were faulty, the engine would run rich ONLY when hot.

## BOSCH VANE-TYPE AIR FLOW SENSOR TESTS

***from the ASPIRE Telediagnostic Hotline***

Many Toyota model vehicles use a Bosch-style mechanical air flow sensor. This meter is part of the air induction system to the engine and produces one of the most important inputs to the fuel injection computer. It measures the volume of air entering the engine and sends a signal to the ECU for fuel injection control. Factory specifications and procedures usually call for a variable resistance test using an analog ohmmeter or a digital ohmmeter with a bar graph display, when testing the airflow potentiometer.

The use of the digital ohmmeter can be tricky. You need to study the display carefully and repeat the test a few times to locate a possible glitch or problem. When in doubt of the readings, Aspire recommends a voltage check of the airflow meter under actual working conditions. This means back probing or using a break-out box to measure the voltage output. We can now see on our voltmeter exactly what the ECU sees. The voltage should change gradually, and increase or decrease without skips or spikes as the door moves. With late- model airflow meters, the voltage sweep decreases as the door open: in early model the voltage sweep increases.

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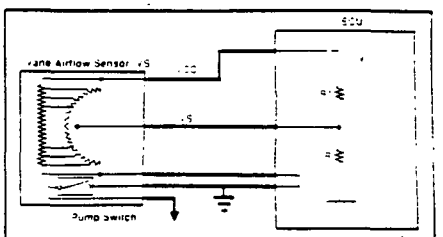
Toyota uses two types of air flow meter designs. Both designs overlapped in model years of use. See 2nd design late-model schematic above.

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This 2nd design was first used in the 1985 5M-GE engine and is used in many TCCS vehicles. Check vehicle service spec for correct application.

## HOTLINE DIAGNOSTIC SERVICES FOR SHOPS & TECHNICIANS

A number of telephone-access diagnostic hotline services are available to the industry. Most of these are by subscription, however complete details can be obtained by calling them. They are:

**ASPIRE** Telediagnostic Service, Morrisville, PA.
Call 800 435 1050 and ask for J R King

**AUTOLINE** Telediagnosis, St. Paul, MN.
Call 800 288 6220 and ask for Rob Schuyt (pronounced SHOOT)

**MITCHELL** On-Line Telediagnostics, San Diego, CA.
Call 800 854 7030 and ask for Eddie Santangelo, x-6504

**AUTOMOTIVE DATA SYSTEMS**, Huntington Beach, CA.
Call 714 892 8330 and ask for Curt Moore

***HI-TECH HOTLINE HELP . . .***

# APPENDIX 5

# Sample Repair Grading Form

# Repair Shop Performance

**For Zip Code: XXXXX** | **Year of Your Vehicle: 1990**

**For: May 1996** | **Age Category: 4 to 10 years**

| | Number submitted for Retest | Percent Passing 1st retest | Percent Receiving a Waiver | Percent Needing ≥ 2 Retests | Repair Effectiveness Index |
|---|---|---|---|---|---|
| Repair Shop A<br>1873 There St.<br>Anycity, 00145<br>(555)123-1234 | 100 | 96% | 2% | 2% | 68% |
| Repair Shop B<br>4625 That St.<br>Anycity, 00141<br>(555)416-1234 | 20 | 98% | 0% | 2% | 84% |
| Repair Shop C<br>976 Which St.<br>Anycity, 00142<br>(555)132-1234 | 40 | 62% | 5% | 33% | 35% |
| Repair Shop D<br>2392 Where St.<br>Anycity, 00148<br>(555)123-1234 | 250 | 99% | 1% | 0% | 79% |

# APPENDIX 6

# Draft Standardized Repair Forms

# APPROACH 1

# DRAFT VERSION OF IM240 REPAIR FORM

Question = Answer =

1. Was the ***root cause*** of the problem mechanical or electrical/electronic?
   - ☐ Mechanical - Proceed to Mechanical Section (question #4) =1
   - ☐ Electrical/Electronic - Proceed to Electrical/Electronic Section (ques. #2) =2

## Electrical/Electronic Section

2. The ***root cause*** of the problem was:
   - ☐ Sensor or Actuator - Proceed to Sensor/Actuator Section =3
   - ☐ Wiring or Connector to sensor or actuator- Proceed to question #5 =4
   - ☐ Battery/power supply or ground problem - Proceed to question #5 =5
   - ☐ Control Unit (ECM, PCM, Ignition Module, etc.) failure - Proceed to question #5 =6

**Sensors/Actuator Section**

3. Which of the following was the ***root cause*** of the problem?:

- ☐ MAP Sensor #7
- ☐ Mass Air Flow Sensor #8
- ☐ Throttle Position Sensor/Switch #9
- ☐ Oxygen Sensor #10
- ☐ Engine Coolant Temp. Sensor #11
- ☐ Manifold Air Temp Sensor #12
- ☐ Engine Speed Sensor #13
- ☐ Idle Actuator #14
- ☐ Fuel Injector/Mixture Control Solenoid #15
- ☐ Ignition Secondary #16
- ☐ Purge Control Solenoid #17
- ☐ EGR Control Solenoid/Electronic EGR Valve Assy. #18
- ☐ AIR Control Solenoid #19
- ☐ Other #20

## Mechanical Section

**4. Which of the following was the *root cause* of the problem?:**

- ☐ Engine Internal #21
- ☐ Engine Ancillary #22
- ☐ Catalyst #23
- ☐ Fuel Pump #24
- ☐ Fuel Pressure Regulator #25
- ☐ Carburetor #26

**AIR System Section**

- ☐ AIR system vacuum supply #27
- ☐ AIR system control valve(s) #28
- ☐ AIR system delivery hose or pipe #29

**Purge System Section**

- ☐ Purge system vacuum supply #30
- ☐ Purge system control solenoid/valve #31
- ☐ Purge system delivery hose or pipe #32

**Pressure System Section**

- ☐ Pressure system valve(s) #33
- ☐ Pressure system hose or pipe #34
- ☐ Gas cap #35

**EGR System Section**

- ☐ EGR vacuum supply #36
- ☐ EGR valve #37
- ☐ EGR vacuum control solenoid/device #38
- ☐ EGR Passages in Engine #39

## Final Section

**5. Were there multiple or other secondary failures repaired as well as the *root cause*?**

☐ **Yes - List in decending order of emissions contribution the answer #'s from above that were repaired:**

_____ #40a
_____ #40b
_____ #40c
_____ #40d

**Repair Form now complete - Thank you!**

☐ **No - Repair Form now complete - Thank you!** #41

# APPROACH 2

## 1 - Fuel System Repair

### General Area
- 111 Air Filter
- 112 Fuel Filter
- 113 Fuel Pressure
- 114 Vacuum Leaks

### Carburetion
- 115 Carburetor
- 116 Idle Circuit
- 117 Accelerator Pump
- 118 Float Circuit
- 119 Main Metering
- 120 Jetting
- 121 IMC Solenoid
- 122 Power Enrichment
- 123 Choke Circuit
- 124 Mechanical
- 125 Electrical
- 126 Open

### Fuel Injection
- 127 Fuel Distribution
- 128 Air Flow Meter (AFC)
- 129 Fuel Distributor (CIS)
- 130 Multi Port (MPI/SMPI)
- 131 Throttle Body (TBI/CFI)
- 132 Injector(s)
- 133 Cold Start/Warm Up
- 134 Cold Start Injector
- 135 Auxiliary Air Valve
- 136 Open

## 2 - Emission System Repair

### Catalytic Converter
- 211 Efficiency
- 212 Mechanical
- 213 Electrical
- 214 Missing
- 215 Open

### Air Injection
- 216 Vacuum
- 217 Mechanical
- 218 Electrical
- 219 Missing

### PCV
- 220 Crankcase Oil
- 221 Vacuum
- 222 Mechanical
- 223 Missing

### Evaporative System
- 224 Vacuum
- 225 Mechanical
- 226 Electrical
- 227 Missing

### EGR
- 228 Vacuum
- 229 Mechanical
- 230 Electrical
- 231 Missing

Draft - Revision 3

## 3 - Computer System Repair

### ECM
- 311 Prom
- 312 Cal Pak
- 313 ECM
- 314 Memory Reset
- 315 Open

### Sensors
- 316 O2 Sensor
- 317 Temperature
- 319 Ambient
- 320 Coolant
- 321 Map/Baro
- 322 TPS
- 323 MAF
- 324 RPM (Cam/Crank)
- 325 Open

### Wiring Problems
- 326 Connectors
- 327 Broken Wires
- 328 Corrosion

## 4 - Electrical System Repair

### General Area
- 411 Basic Wiring
- 412 Battery
- 413 Alternator Output

### Ignition
- 414 Coil/Coil Packs
- 415 Distributor
- 416 Pickup Coil/Hall Effect
- 417 Module
- 418 Rotor/Cap
- 419 Mechanical
- 420 Secondary Leads
- 421 Spark Plugs
- 422 Open

## 5 - Engine Mechanical Repair

### Heads
- 511 Valves
- 512 Gaskets
- 513 Cracks

### Cam
- 514 Chain/Belt
- 515 Modified
- 516 Mechanical

### Piston/Crank
- 517 Rings
- 518 Broken/Burnt

### Coolant System
- 519 Thermostat
- 520 Radiator

## 6 - Drive Train Repair

### Transmission
- 611 Automatic Trans
- 612 Electrical
- 613 Mechanical
- 614 Manual Trans
- 615 Electrical
- 616 Mechanical

### Rear Axle
- 617 Ratio
- 618 Electrical
- 619 Mechanical

### TransAxle
- 620 Ratio
- 621 Electrical
- 622 Mechanical

### Lubricating Fluids
- 623 Transmission
- 624 TransAxle
- 625 Rear Axle
- 626 Transfer Case

# Vehicle Repair Summary

**Repair Costs**

**Parts** [ ][ ][ ].[ ][ ]

**Labor** [ ][ ][ ].[ ][ ]

**Repair Facility #** [ ][ ][ ][ ][ ]

**Non Registered Repair Facility (Y/N)** [ ] **Home Repair (Y/N)** [ ]

**Technician #** [ ][ ][ ][ ] **Repair Date** [ ][ ] [ ][ ] [ ][ ]

**VIN** [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]

**License Plate #** [ ][ ][ ][ ][ ][ ][ ] **Test Certificate #** [ ][ ] [ ][ ][ ][ ][ ][ ]

***Write or code appropriate number into block next to area of repair.***

***1. Replace 2. Serviced 3. Warranty***

Bar Code Information