

# Inspection Update

A Publication of the Massachusetts Enhanced Emissions and Safety Test Program

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## OBD II Training Starting Soon

### Course Mandatory For Registered Repairers

Repair technicians will have ample opportunities this spring to take advanced OBD II training before it becomes a requirement for all registered repairers.

Massachusetts Bay Community College (MBCC) is offering an advanced course in OBD diagnostic and repair techniques at seven different locations, in association with the contractor for the *Enhanced Emissions & Safety Test* program, Applus+ Technologies.

The course has been designed and scheduled with a new requirement in mind: Soon, no one will be allowed to be a registered repairer in Massachusetts unless he or she has taken advanced OBD II training. The actual date for implementing this mandate has yet to be determined.

Alternatives to the course are available for technicians who have previously taken the training or who believe they have attained enough knowledge of OBD II to make formal training unnecessary at this time.

### See Related Articles , Pages 3, 4 & 8

The course consists of 16 hours of classroom instruction over four nights, plus a four-hour, hands-on session one Saturday morning. The cost per student is \$349, plus \$62.50 for a manual and other course materials.

To spur enrollment, the state is offering a \$112.50 per-student subsidy on a

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## Latest Software Takes Aim at Computer Lock-Ups, Other Workflow Impediments

Vehicle inspectors are less likely to experience time-wasting computer lock-ups as a result of recent upgrades to the *Enhanced Emissions & Safety Test* software. This was perhaps the most significant improvement brought about by two new software releases in February.

The upgrades also corrected a problem inspectors encountered while scanning identification numbers of some late-model vehicles, and made it easier for inspectors to determine the causes of leak check failures. In addition, the new software allows equipment auditors to do their work more efficiently, which means less downtime for stations.

"We realized how frustrating it can be for an inspector to have his workstation lock up in the middle of a test and have to reboot it," said **Terry Hayes**, deputy program manager for Applus+ Technologies, the state's I&M contractor.

"We worked very hard to solve this problem insofar as it can be addressed through improving the software."

Not every workstation computer lock-up can be eliminated through a software fix, Hayes pointed out. There are times, for instance, when a sudden high demand on a station's

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## I&M Contractor: We've Completed Equipment Upgrades, Replacements

*Enhanced Emissions & Safety Test* contractor Applus+ Technologies reported that a \$15 million, six-month project to upgrade or replace the emissions testing equipment used in the program was completed in late February.

More than 700 testing stations that had been using ESP equipment since the beginning of the program five-plus years ago received new, state-of-the-art equipment manufactured by SPX, Applus+ said, while 817 stations originally equipped by SPX were upgraded to an equal level of new technology.

ESP equipment is no longer used in the *Enhanced Emissions & Safety Test*.

The equipment upgrade/replacement project was part of a comprehensive plan to make the emissions test more accurate, dependable and effective. The result is an "emissions test that the public can have great confidence and trust in," asserted **Jack Pierce**, program manager for Applus+ in Massachusetts. "It's an accurate, fair and reliable test."

**Terry Hayes**, assistant program manager for Applus+, praised inspection station owners and employees for their cooperation and assistance. "Were it not for the people at the stations working cooperatively with us every step of the way, we would not have been able to complete this project on time," he said.

Hayes said he was constantly encouraged by the way inspectors at stations transitioning from ESP to SPX applied themselves to "learning the intricacies and idiosyncracies of the SPX workstation." ■

# Lock-Ups Reduced by Better Communication with Peripheral Devices

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power supply, or a power interruption, will trigger a lock-up. Hardware malfunctions can also cause lock-ups, such as when the command to print a report is given but the printer can't do perform the task because it is out of toner.

A software-related lock-up can add anywhere from four to six minutes to the typical inspection, which is the time it takes to re-boot and re-start the test. "These kinds of lock-ups have occurred, for the most part, at the beginning of the inspection, when it's fairly simple to re-start the test," Hayes said. "But even then, the time lost was a big deal for the inspector and the station, especially if it happened at a busy time, with customers lined up, waiting for an inspection. We weren't happy with the situation at all."

The problem came to a head last fall as stations with ESP workstations began switching to SPX equipment as part of an agreement between the state and Applus+ to make the emissions test more accurate.

"The ESP workstation has an OS 2® operating system, whereas SPX is Windows®-based," Hayes explained. "Many of the former ESP stations found the SPX operating system more cumbersome at first. Their difficulties were compounded by the fact that SPX performs more functions; therefore, it is a little slower than what they were used to."

Hayes continued, "To simplify what happened: People who always had SPX equipment knew how to run it in a way that made

lock-ups less likely. The former ESP stations, lacking that experience, ran the new equipment like they ran the old, which made lock-ups more likely because of certain tendencies, or weaknesses, in the software. The software was to blame, not the guys who used to have ESP."

The new software has solved the lock-up problem in large part, Hayes said, by strengthening the ability of a workstation's central processing unit to communicate with its peripheral devices, such as the dynamometer, gas cap tester, infrared remote and VMAS. "You have to keep in mind that the computer is pulling a tremendous amount of information from the peripheral devices in a very short amount of time," he said. "It's pretty amazing what it does." ■

## Other New Software Features Further Smooth Vehicle Inspection Process

Here's what the other recent, notable software upgrades have accomplished:

- **Eliminated VIN Scanning Snafus.** For many years, the vehicle identification numbers (VINs) of virtually every automobile were composed of 17-digit barcodes preceded by the letter "I." This was a standard established and encouraged by the Society of Automotive Engineers (SAE). But, over the last few years, some manufacturers have departed from the standard by dropping the "I" from the barcode. That has been the case, for example, with late-model BMWs, Fords, Mazdas and Saabs. Unfortunately, that little dropped "I" caused a big problem for the software, which had been written to look for it in every barcode when the inspector scanned the vehicle; not seeing the "I," the computer would refuse to scan it. The only way for the inspector to proceed then was to enter the VIN manu-

ally two times in succession, a practice referred to as double-blind entry. A minute or two could easily be spent "double-blinding" — or more if the inspector hit a wrong key and had to start over. With the new software, a VIN will scan whether it has an "I" prefix or not.

- **Provided Time-Saving Info on Leaks.** Previously, when a leak check was performed, the software was programmed to tell the inspector only that the testing equipment passed or failed. It would not indicate whether the leak was occurring in the sample pump or the sample line, an ambiguity that led to wasted time and impeded productivity. A line leak can be repaired on the spot by the inspector, whereas a pump leak requires a service call. The new software provides two on-screen measurements that point conclusively to the source of the leak. "This information is crucial to minimizing down-

time," said Terry Hayes, "and it has positive implications for equipment maintenance, and emissions repair work, too."

- **Shaved Minutes Off Audits.** The software has been altered to enable more efficient equipment audits. While the increased productivity amounts to only a few minutes per audit, the overall effect is tremendous, considering that every inspection station in the 1,500-plus-member network undergoes four compliance audits per year by Applus+, plus two state-sponsored audits. "For an individual station operator, I realize this might not seem like much of an improvement," Hayes said. "But I know that our company and the Commonwealth are sensitive to the inconveniences and delays that stations experience because of audits. Anytime we can make this process less burdensome, we will do so."

- **Switched on CAN.** Every station now has the capacity to perform OBD II emissions tests on recent-model vehicles (model year 2002 and newer) equipped with controller area network (CAN) technology. "The difference between OBD without CAN and OBD with CAN is like the difference between an internet hook-up using a 28K modem and a direct service line," said Chuck Pearson, a master trainer affiliated with Massachusetts Bay Community College. "It's that much faster and better." ■

*Inspection Update* is published quarterly and distributed to the automotive service and repair industry in Massachusetts by the Department of Environmental Protection and the Registry of Motor Vehicles, in association with Applus+ Technologies.

Our mission is to help foster the success of the enhanced vehicle inspection and maintenance program by providing news and useful information to vehicle inspectors and repair technicians in a timely fashion.

We also want to facilitate the sharing of helpful information among people within the industry. Toward that end, we encourage our readers to contact us with their suggestions, observations

and constructive criticism. Ideas that would benefit the industry as a whole will be presented in subsequent editions of *Inspection Update*, as space allows.

To register your comments, please e-mail or phone:

**John Hahey**  
The Minahan Companies  
617-451-8600

[jhahey@theminahcompanies.com](mailto:jhahey@theminahcompanies.com)

The Vehicle Maintenance Initiative Committee (VMI), composed entirely of volunteers from the repair industry, serves as *Inspection Update's* editorial advisory board. William Cahill, of B.C. Auto Repair, Randolph, is chair of the VMI Committee.

## Some of the Things You'll Learn to Do At Upcoming Advanced OBD II Course

There are at least 12 good reasons to take an advanced OBD II technical training course like the one about to be offered at multiple locations in Massachusetts under the sponsorship of Massachusetts Bay Community College. *See related articles on Pages 1, 4 and 8.*

Take this course. Attend every session. Do the required work. Then you'll know how to:

### 1. Interpret data without fault.

Don't miss a critical diagnosis because your scanner fed you default data and you thought it was live. There's a 30-second procedure to avoid this common (and painful) mistake.

### 2. Deal with vehicles that won't complete monitors.

You will learn not only which makes and models are most likely to fall into this category, but also how to deal with the problem.

### 3. Understand how drive cycles differ from enabling criteria.

Knowing this alone could save your customers hours of driving in a misconceived attempt to make vehicles ready for re-testing, and you won't waste time (and lose money) re-checking those vehicles for readiness.

### 4. Identify a "conflicting condition."

Life is a little easier for a technician who can quickly identify a conflicting condition and confirm a repair even before the monitors have completed.

### 5. Match wits with a scan tool salesperson.

Don't be sold the wrong tool because you don't know the right questions to ask a salesperson. These days, you need bi-directional control, freeze frame, and manufacturer side data to diagnose and fix certain cars.

### 6. Avoid code-clearing nightmares.

Say no to woe: There are solid reasons to resist the temptation to clear those codes. Spend your nights sleeping and dreaming, not weeping and screaming.

### 7. Control areas where there are networks.

Controller Area Network (CAN) is the latest big leap in on-board diagnostic technology. Control your fate by moving your knowledge forward at the same pace as the technology.

### 8. Explore new CAN pathways.

With CAN, many sensors no longer report directly to the powertrain control module (PCM). This means you need some new tricks to uncover critical repair information.

### 9. Master Mode 6.

There are critical diagnostic data to be gained through a mastery of Mode 6. You'll quickly see why repairers in the know are so excited by this new technology.

### 10. Spot "false" codes.

Where there are multiple code failures, there are often false codes. If you don't want to replace perfectly good parts, you have to be able to separate the false from the real.

### 11. Think like a car thinks about evaporation.

Knowing how a car "thinks" has never been more critical than in the area of evaporative emissions control systems. You're guaranteed to have a more thoughtful approach to evaporative code failures after taking this course.

### 12. Keep abreast of new rules, protocols.

Avoid customer complaints by having the latest, most-up-to-date information on inspections – the rules and protocols for testing and retesting cars and trucks, performing emissions repairs, and applying for waivers. ■

Bert Cox, chief of vehicle programs for the Massachusetts Department of Environmental Protection, and Chuck Pearson, special assistant to the MassBay Technology Center, contributed to this article.

**See Page 8 for Course Dates, Times, Locations**

## Applus+ Makes the Grade in Agbar Re-Branding Effort

The contractor for the *Enhanced Emissions & Safety Test* program has changed its name.

Effective February 11, Agbar Technologies became Applus+ Technologies.

"This is a name change only," emphasized **Jack Pierce**, the Applus+ program manager in Massachusetts. "Our new name reflects a marketing and branding initiative."

The switch from Agbar to Applus+ does not affect the way the company does business. "Our ownership, management and contract commitments have not changed, and

are not affected in any way by the name change," said Pierce.

As Applus+ Technologies, the company remains affiliated with the Agbar Group. The main subsidiary under the Agbar Group adopted the Applus+ name in 2003; subsequently, all affiliated companies under that subsidiary have assumed new names incor-

porating the name Applus+ and the Applus+ logo.

"Massachusetts inspection stations may have noticed that we have already begun using the new name and logo in our financial transactions," said Pierce. "This is because we have been rolling out our new name in stages over the past year."

All company correspondence now bears the Applus+ Technologies name. Likewise, all checks for transactions with the company should be made out to Applus+ Technologies, Pierce noted. ■

**Applus+**<sup>+</sup>  
Technologies



## Q & A with MassBay's Howard Ferris

# Tip to Repairers: Grab OBD II Training Bargain

Howard Ferris is director of automotive technology education programs for Massachusetts Bay Community College (MBCC), Wellesley, and director of the MassBay Technology Center, Ashland. These roles put him at the center of plans and preparations for an upcoming round of advanced OBD II technical training; this kind of training is now mandatory for those who want to become or remain registered emissions repairers. In this interview with "Inspection Update," Ferris strongly encourages technicians to take the advanced OBD II course, emphasizing that training is the fastest, most direct route to improved skills and earning power.

### If I'm an automotive technician, why should I now invest money and time – 20 hours – in advanced OBD II training?

It will make you a better emissions repairer and a more efficient repairer. If you're more efficient, you can make more money. Plus, this course is very inexpensive when the cost is weighed against what you'll gain from it.

### You call \$349, plus \$62.50 for course materials, inexpensive?

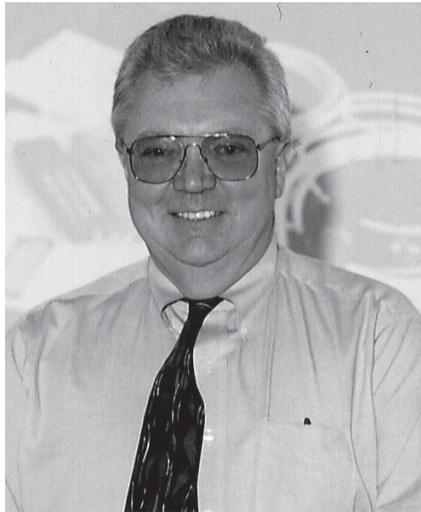
You bet. Spending a little over \$400 one time to become a better repairer for life is a bargain. Besides, the actual cost for many technicians is going to be \$299 because the state is granting \$112.50 subsidies to as many students who sign up as possible.

### Why can't I just read up on OBD II and do my own research when a problem comes up?

You *should* read everything on OBD II that you can get your hands on. But there are at least three reasons why independent reading and research cannot substitute for good classroom instruction and hands-on training.

One, you can't ask questions of a certified master instructor in a book. You have to go to class to do that.

Two, a formal training program is the best, quickest way to develop critical thinking skills – skills you must have to devise reliable strategies to attack a difficult repair. If your thinking is faulty, that's going to become apparent sooner in a classroom setting than anywhere else.



Howard Ferris

Three, in the classroom you benefit greatly from the interactions that take place among students and faculty. There are those great, unplanned moments when a new way of looking at an automotive problem emerges from the group discussion.

### How often does that really happen?

It happens in every advanced course I've ever seen. Inevitably, a student finds that the problems he has on the shop floor are the same or similar to the problems other students are having. There's nothing like a common problem to unleash the critical thinking abilities of the group.

### Are there other benefits to taking formal OBD II training?

Taking this course will get you up to speed on OBD II in the shortest amount of time possible. It condenses the information you must have to be a top-performing tech. You're going to learn how to diagnose emissions failures in models that are prone to trouble. This is knowledge that might take you months or even years to develop on the shop floor.

I have to put a good word in, too, for the Technology Center: It has an atmosphere that is especially conducive to learning.

### You're talking about the hands-on session?

That's right. No matter where you take the course – and we'll be conducting it at eight sites around the state – you'll do the final session, the hands-on, at the MassBay Technology Center in Ashland. Everything there reflects the latest thinking in automotive technology: the lay-out, the equipment, the technology, the methods of instruction, etc.

### What level should I be at to take an advanced OBD II course like this?

You should be a master tech certified by ASE in engine performance or electrical. Preferably, you're a certified L-1 tech, too. This is for someone who's had training and been in the field for at least five years.

### Is there anything new and different in this course?

Yes. One whole night is devoted to Mode 6 and CAN. (*Controller Area Network* – CAN – is a new OBD II system that began appearing in model year 2002 and has come into greater use in subsequent years.)

### Why are Mode 6 and CAN worth four hours of instruction time?

In most new cars, the various computers are now networked together. Because of CAN, the computers now talk to one another, and that has changed the way we have to diagnose an emissions failure. The connectivity of the computers is great, but that very connectivity can create situations that throw you off course.

### If you could say just one thing to somebody who's on the fence about taking this course, what would it be?

Think about the last time you had an unusually difficult repair and how it ate up so much of your time and energy. Then answer this question honestly: How much quicker could I have diagnosed and repaired that car, and how much more money could I have made on that vehicle, if I had had advanced training? ■

See Other Articles on  
Training, Pages 1, 3 & 8

## Better Route to Recertification Opening Shortly — Take Test Online, Inspectors, Whenever You Want

The plan to move vehicle inspector recertification onto the Web is alive and well.

Over the past year, state agencies and I&M contractor Applus+ Technologies have been moving steadily through a long list of issues that need to be addressed before inspectors can take recertification tests online.

“Online recertification will be easier and faster for inspectors,” said Bert Cox, chief of vehicle programs for the Massachusetts Department of Environmental Protection. “Most inspectors will be able to get recertified without leaving the shop floor. That will be a tremendous convenience.”

Work on the online recertification web site is now in the final stages. As of the copy deadline for this edition of *Inspection Update*, online recertification was slated to begin in April.

Many key features of online recertification have been finalized:

- The test will consist of 50 questions in categories corresponding to those in the inspector training manual.

- To pass, inspectors will have to score 76 percent or higher.

- At any point during the test, an inspector may access pertinent information in an online copy of the inspector training manual; above each question, there will be a link to the corresponding section of the manual.

- The test will present one question per screen, and there will be no time limit for completing the test.

- Inspectors may save the sections they've finished, and complete the test in as many sessions as they'd like.

- Inspectors will be allowed to take the test up to three times within a 45-day period.

- If an inspector fails the test three times, he/she will be required to take the initial inspector training course again at a cost of \$150.

- Inspectors who do not have access to a computer with internet access at home or work will be able to take the

test at one of the five Applus+-run Diagnostic and Training Centers (DTCs).

- If an inspector does not pass recertification in three attempts before his/her license is up for renewal, the inspector will be locked out of his/her workstation.

- To get back into the program, a locked-out inspector will have to take initial inspector training again and pass the recertification test.

Applus+ and state officials are still reviewing options for beta testing and rolling out the new inspector recertification system and Web site, which will be found at [www.massrecert.com](http://www.massrecert.com).

Over the next several weeks inspectors should be on the lookout for workstation messages with updated information on this more convenient route to recertification. Once the new online training process goes into effect, inspectors will be notified by mail when they're due for recertification. ■

## Register for Upcoming OBD II Training on New MassBay Web Site

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first-come, first-served basis. Because the subsidy fund is limited, repairers are urged to sign up early.

The 284 registered repairers who took one of the previous state-sanctioned OBD II courses do not have to take the course this spring. They are required, however, to attend a one-night refresher class on Controller Area Network (CAN) and Mode 6 technologies. Students taking this class will pay only for the manual, \$12.50.

Registered repair technicians who have either received other training or studied on their own may “test out” of the state OBD II training requirement by taking a 100-question challenge exam and scoring 80 percent or better on it.

MBCC is using ASPIRE-certified master instructors for both the full course and the refresher.

“With the constant changes in automotive technology, ongoing training is a must for any technician who really cares about doing the job right and serving the customer well,” said Howard Ferris, MBCC's director of automotive programs. “This course represents one of the best educational values I've ever seen. And if you receive the \$100 subsidy, it's an incredible bargain.”

Bert Cox, chief of vehicle programs for the Massachusetts Department of Environmental Protection, echoed that thought, calling the 20-hour course “an exceptional training opportunity.”

Cox said, “Not only will it help you maintain your registered repairer status, but it will also speed your diagnostic time, help you avoid common mistakes, and establish you as the kind of expert advisor every customer wants.”

**MBCC has made it easy for technicians to enroll in advanced OBD II technical training through its new Web site, [www.massbaytraining.com](http://www.massbaytraining.com), or by contacting Chuck Pearson, at 781-239-3048.**

Last September, the Vehicle Maintenance Initiative (VMI) Subcommittee, a subgroup of the I&M Advisory Committee, set the stage for the upcoming round of training courses when it voted unanimously to make advanced OBD II training mandatory for registered repairers. The subcommittee, composed entirely of certified technicians and repair shop owners, took the position that continuing education is as essential for automotive technicians as it is for other professionals if they are to retain the public's trust. ■

# Consider the Basics: A Triple Master's Lesson

By Brian Manley

One of my favorite sayings is, "We're on the same path, but we're just at different points on the path." The saying comes in handy as I teach auto technology. I've



Brian Manley

taught basic electrical fundamentals to teenagers and adults alike, and I've come to understand that the "path" is not age-related. We move forward on the path as we add to our arsenal of knowledge and enhance our ability to diagnose and repair vehicle systems.

Each year, I teach Level II (Advanced Auto) and Level III students (Auto Specialists). My Level II students begin with our General Motors Specialized Electronic Training (SET) boards, learning the basics of series and parallel circuits, voltage drop testing, current flow, resistance measurement and meter usage. We move through most of GM's SET curriculum in a few weeks, building dozens of different circuits on the boards. When the students are ready, they apply their skills in the shop.

My Level III students tackle most of our customer vehicles that come into our shop. These young men and women are further down the path. They can perform some advanced electrical diagnosis and use advanced features on our scan tools. These students can grab a lab scope and diagnose a throttle position sensor (TPS) or an O<sub>2</sub> sensor just about as fast as I can. If an auto tech does not have a firm grasp of these basic concepts and procedures, the results are incorrect diagnoses and parts swapping.

*Brian Manley is a vocational automotive instructor for the Cherry Creek School District in Aurora, Colorado. He is an ASE triple master certified technician and a member of the National Automotive Technicians Education Foundation (NATEF) Board of Trustees. He can be reached at [manley\\_brian@hotmail.com](mailto:manley_brian@hotmail.com). This copyrighted article first appeared in the November 2004 edition of *Autolnc. magazine*, a publication of the Automotive Service Association, and is reprinted with the permission of *Autolnc.* and Mr. Manley.*

## Case Study: 1991 Geo Storm 1.6L SOHC

This little black coupe came to us recently with a complaint of a misfire, along with poor engine performance. Longing to give my Level II students a crack at a customer car, we pulled the coupe in cold and began diagnosing.

The engine had a rough idle – a hard misfire – and some overt signs that it lacked maintenance. There were some oil leaks, worn drive belts, corroded battery cables and a dented fender. But it only had 78,000 miles. I took each student to the tailpipe and showed them what a dead miss feels and sounds like. I also explained to my Level II students that even though this was an engine misfire, what they have learned about electrical fundamentals would play a role in diagnosing the root cause of this car's problem.

I wanted to turn some of the diagnostic control over to some sharper techs-in-training, so with two of my Level III students leading the diagnosis, they began to check for answers to the following questions:

- What is the engine's mechanical ability?
- How is the ignition system?
- Is there fuel delivery to the injectors?
- Could any of the emission control devices be at fault?
- Is the power control module (PCM) in fuel control?

All of these systems needed to be confirmed as operating properly, so I suggested that they figure out a way to power balance the engine. One student used the pull-the-wires-off-and-watch method, while another rolled our ignition analyzer over and hooked it up for a safer power-balance test. It turns out that both methods revealed the same suspect: the No. 4 cylinder was not contributing, although all cylinders had adequate firing lines, spark duration and coil capacity.

Next, one of the specialists pulled out the spark plugs and performed a compression test. All cylinders were 135-145 pounds per square inch (PSI). For demonstration purposes, I had the students perform a run-

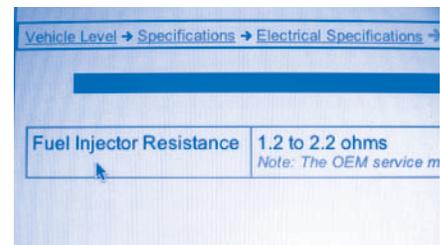
ning compression test as well, to show how much more cylinder pressure is created during cranking, as opposed to idling. Again, all cylinders idled at around 60 PSI and snap-throttled to about 100. These results were enough to convince them that the engine had adequate compression to do its job.

"So," I asked, "What's next?"

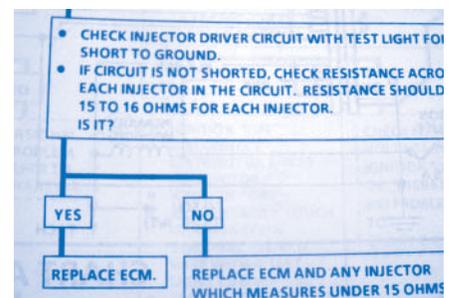
Before moving on, one student plugged a noid light into the injector harness connector for the No. 4 injector to test for trigger; we had fire. Next, they decided to blame the injector, so I asked them how they were going to either confirm proper operation or condemn it as being faulty.

"Check resistance," said one of my Level II students.

I knew we'd work electrical fundamentals into this diagnosis somehow! They tested the No. 4 injector, which read 1.7 ohms, while another student went to our information system for specs. Information can be difficult to find, so when he came back saying "1.2 to 2.2 ohms," I was puzzled. "Why is the spec so low," I thought. I had them test another injector – in this case, the No. 1 injector. The reading came back "17 ohms."

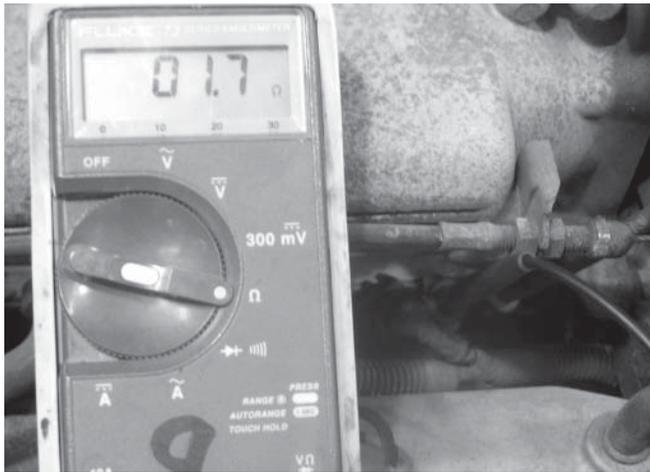


Information provider gives a resistance specification of 1.2 to 2.2 ohms.

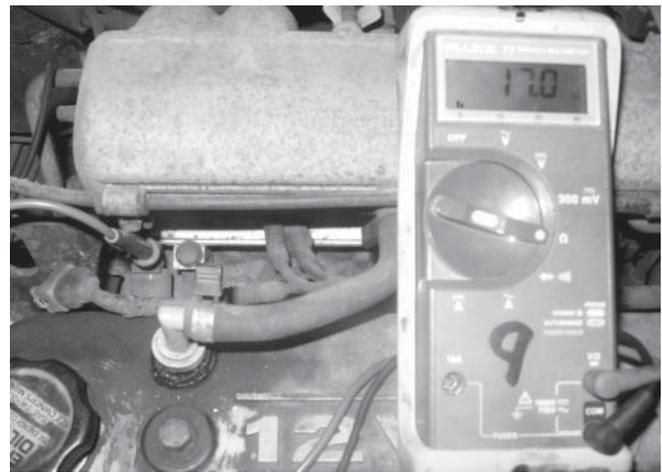


Correct specification for the injector resistance.

# Lesson on Misfires and Electrical Resistance



Meter reading shows 1.7 ohms for the number 4 injector.



Meter reading shows 17.0 ohms for the number 1 injector (a "good" injector).

So I asked the class which one was defective. A couple of students piped up, saying, "The No.1 injector must be bad." "How can that affect the No. 4 cylinder?" was my response. I found the spot on the path of inquisition where, in this situation, all of my students were stumped.

"Trust No One."

This is another of my favorite sayings, borrowed from agent Fox Mulder of *The X-Files*, that I was about to put to good use. I checked the resistance spec on our information system. Sure enough, the student had the correct vehicle entered, and the spec was 1.2 to 2.2 ohms.

We then grabbed the GM service manual off of the shelf and searched for chart A-3: "Engine Cranks But Won't Run." This chart has the injector driver circuit diagnostic procedure, complete with a resistance spec for the injector: 15 to 16 ohms.

So now my question was, "Which specification is correct?" As we pondered that question, I asked another, "Do No. 1 and No. 4 injectors have anything in common?" As we scrutinized the wiring schematic, we found that injectors No.1 and No. 2 fired in pairs as did No. 3 and No. 4.

There was no direct electrical relationship there, but one of the student's observations led to an important lesson in Ohm's Law. He noticed that the engine ran better with the No. 4 injector unplugged.

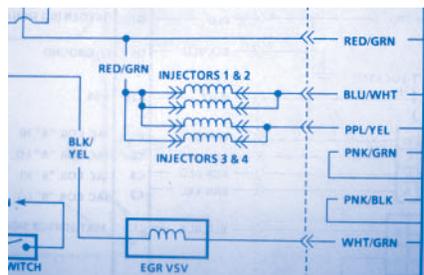
"Why," I asked. Then came the response I had hoped for: "Because the resistance is different?"

## Injector Resistance

Injectors are of either low or high impedance. Injector impedance describes the electrical resistance of the solenoid windings. These are usually grouped into two categories: low and high.

Low impedance injectors range from 2-4 ohms. High impedance injectors range from 12-16 ohms. The impedance of the injector determines what type of driver in the PCM is used. Low impedance injector drivers (peak and hold) allow more current to flow to open the injector faster, and ramp it down to hold it open. High impedance injectors use a saturated switch-type driver. They will open a little slower, 5-1 ms, and the current will stay more constant once the coil is saturated. The point being is that not any injector can be used with any PCM.

The No. 4 injector was using more current than it was supposed to, robbing No. 3 of enough current to stay open long enough. When the shorted injector was disconnected, the No. 3 injector resumed normal operation, causing a smoother idle.



Wiring schematic for the four injectors.

## More Testing Methods

Many techs use a noid light to prove a signal from the PCM. This test tells us nothing about supply voltage or injector pulse width. All a noid light will do is let you know that the injector driver in the PCM is going to ground. Do we have a good injector ground?

Most techs now use the digital storage oscilloscope (DSO) as a common diagnostic tool for injectors, as well as all inputs and outputs. Many technicians look at an injector's voltage pattern to confirm supply voltage and good ground, inductive kick when the injector is turned off and a measurement of pulse width. Others use a low amp current probe with their DSO to scrutinize the waveform.

We pulled out our Fluke 98 and demonstrated both methods of waveform analysis, each one identifying the No. 4 injectors as inoperative.

## From Ohm's Law To Waveform Analysis

Our case study provided many lessons for my students, and I hope it helped to remind many veterans to stop and consider the basics before branching off to an erroneous conclusion. As a teacher and a technician, I am constantly searching for opportunities to move further down the path. If I don't keep moving down the path, I'll get run over. ■

# Advanced OBD II Training Schedule

## FEATURING MULTIPLE CONVENIENT LOCATIONS

An advanced OBD II training course is starting soon at seven convenient locations around the state.

The course consists of 16 hours of classroom instruction over four nights, plus a four-hour, hands-on session one Saturday morning. No matter where a repair technician takes the classroom instruction, the hands-on session will be at the MassBay Technology Center in Ashland.

To enroll, visit the Massachusetts Bay Community College web site, [www.massbaytraining.org](http://www.massbaytraining.org). Registration forms may also be filled out and faxed to the college. To request a form, call Chuck Pearson, 781-239-3048.

The course will be offered at:

### ASHLAND

MassBay Technology Center  
250 Eliot St.  
May 9, 11, 17 & 19, 6:00-10:00 p.m.  
Hands-On, May 21, 8:00 a.m.-12 Noon

### SHREWSBURY

Shrewsbury Diagnostic & Training Center  
175 Memorial Dr.  
May 31; June 1, 7 & 9, 6:00-10:00 p.m.  
Hands-On, June 11, 8:00 a.m.-12 Noon

### WOBURN

Woburn Diagnostic & Training Center  
10-V Gill St.  
May 16, 18, 24 & 26, 6:00-10:00 p.m.  
Hands-On, May 28, 8:00-12 Noon

### BOURNE

Upper Cape Cod Regional  
Technical High School  
220 Sandwich Rd.  
May 23, 25 & 31; June 2, 6:00-10:00 p.m.  
Hands-On, June 4, 8:00 a.m.-12 Noon

### WELLESLEY

Massachusetts Bay Community College  
50 Oakland St.  
June 27 & 29; July 5 & 7, 6:00-10:00 p.m.  
Hands-On, July 9, 8:00 a.m.-12 Noon

### WEST SPRINGFIELD

West Springfield Diagnostic &  
Training Center  
33 L St.  
June 6, 8, 14 & 16, 6:00-10:00 p.m.  
Hands-On, June 18, 8:00 a.m.-12 Noon

### BRIDGEWATER

Bridgewater Diagnostic & Training Center  
30 Bedford Pk.  
June 13, 15, 21 & 23, 6:00-10:00 p.m.  
Hands-On, June 25, 8:00 a.m.-12 Noon

## OBD II Training Costs

Full 20-hour course: \$349,  
plus \$62.50 for manual and course  
materials.\*

Refresher: \$12.50

Challenge Test: \$49

\* Sign up early! A \$112.50 per-student sub-  
sidy is available on a first-come, first-served  
basis.

## UPDATE/REFRESHER CLASSES

Registered repairers who took one of the previous state-sanctioned OBD II courses do *not* have to take the course this spring. However, they are required to attend a one-night refresher class on Controller Area Network (CAN) and Mode 6 technologies.

Refresher classes will be held on multiple dates, and at seven different locations. Every class will begin at 6:00 p.m. Here's the schedule:

**May 12 and June 23**, MassBay Technology Center, 250 Eliot St., Ashland

**May 12 and July 7**, Woburn DTC, 10-V Gill St., Woburn

**May 26**, Upper Cape Cod Regional Tech HS, 220 Sandwich Rd., Bourne

**June 2**, Shrewsbury DTC, 175 Memorial Drive, Shrewsbury \*

**June 9**, West Springfield DTC, 33 L St., West Springfield

**June 23 and July 14**, Bridgewater DTC, 30 Bedford Park, Bridgewater

**June 30**, MassBay Wellesley Campus, 50 Oakland St., Wellesley

\* The Shrewsbury Diagnostic and Training Center has replaced the DTC formerly located in Oxford.

## CHALLENGE TESTS

Registered repair technicians who have either received other training or studied on their own may "test out" of the state OBD II training requirement by taking a 100-question challenge exam and scoring 80 percent or better on it.

The challenge test will be given:

**Tuesday, April 26, 6:00 p.m.**

MassBay Wellesley Campus  
50 Oakland St.  
Wellesley

**Thursday, April 28, 6:00 p.m.**

West Springfield DTC  
33 L St.  
West Springfield



## Development Steps Eat Up the Calendar

# New Emissions Test Software Can't Be Rushed

For those who develop new software for the *Enhanced Emissions & Safety Test*, the route from concept to development to implementation isn't necessarily a direct or easy one.

"I understand why people in the network look at a problem that can be fixed by new software and ask, 'Why does it take so long fix?,' said **Terry Hayes**, deputy program manager for Applus+ Technologies in Massachusetts. "I'd feel that way, too, if I had never gone through the process from the delivery side."

There are seven distinct steps that must be taken before an upgraded version of the test software can be put into daily use in the program, according to Hayes:

1. Precisely identifying the suspected flaw, weakness, or inadequacy in existing software;
2. Writing a new software package to address that issue;
3. Testing the new version to verify that it can produce desired solution;
4. Producing new-version CDs for all 1,500-plus inspection facilities;
5. Distributing CDs to all inspection facilities;
6. Installing new software on workstations at all facilities; and
7. Locking-out/abandoning old software.

Hayes said the third step is the most complicated, time-consuming and anxiety-filled part of the process. "First, we take the new software to one of the DTCs (Diagnostic and Training Centers) and we test it every possible way for a week," he said. "If it works well at the DTC, we try it for an entire day at one of the high-volume inspection stations.

"Then we do an in-depth check to make sure the test records and calibration records from that one-day exercise have been uploaded to the VID. Next, we check to see that all the files (of vehicles tested with the new software) have been uploaded accurately and completely to our computer system and to ALARS (Automated Licensing and Registration System).



*"Our vehicle test and the software paths that we take to perform it are very, very complex compared to most other states with enhanced I&M programs. The inspectors and repairers of Massachusetts should be proud that they're at the cutting edge of this technology."*

- **TERRY HAYES**  
Deputy Program Manager  
Applus+Technologies

"We have to be very sure at this point that everything with the new software is working right. The only way we can do that is by performing an exhaustive quality control check of how it functioned during the beta test (at the high-volume station). This really soaks up the time."

Depending upon several variables, such the extensiveness of upgrades being made and problems encountered during the testing phases, it can take anywhere from two to six months to complete a new software release. At any given time, Applus+ is working internally on two to four new software releases, but not every release in development finds its way to program-wide implementation.

Applus+ contracts with the SPX Corp. of Kalamazoo, Michigan, to develop new software. SPX is also the current main supplier of the emissions testing equipment used in Massachusetts.

"In adding a new feature or updated component to the software, we have to be careful not to disturb something else downstream (in the software)," Hayes said. "The more times you change the software, the greater the danger of creating a new problem somewhere else in the program. We

worry a lot about this downside possibility, so we take a good, hard look at how the new (software) version functions in its totality during beta testing. We try to be on guard everywhere against unintended consequences."

Hayes has held management positions at Applus+ and its predecessor companies for most of the six-plus years of the *Enhanced Emissions & Safety Test*. Though not a software engineer, he has spent countless hours in consultation with SPX developers and he has often found himself preoccupied with software-related issues. All this has left him with a profound appreciation of the complexity of the software at the technical core of the test.

"We have one of the most complex software packages in the country, no doubt about it," he said. "Our vehicle test and the software paths that we take to perform it are very, very complex compared to most other states with enhanced I&M programs. The inspectors and repairers of Massachusetts should be proud that they're at the cutting edge of this technology." ■

## Inspectors Need Good Judgment, Common Sense When Evaluating Loud Mufflers, Exhaust Systems

### Some Web Sites Offering Helpful Info to Repairers

[www.iatn.net](http://www.iatn.net)

[www.indentifix.com](http://www.indentifix.com)

[www.lindertech.com](http://www.lindertech.com)

[www.motorage.com](http://www.motorage.com)

[www.howstuffworks.com](http://www.howstuffworks.com)

[www.hi-tektraining.com](http://www.hi-tektraining.com)

[www.asashop.org](http://www.asashop.org)

[www.autoinc.org](http://www.autoinc.org)

[www.motor.com](http://www.motor.com)

[www.nastf.org](http://www.nastf.org)

### Helpful Web Sites on Drive Cycles

Web sites to visit when needing information on readiness for OBD II testing and on drive cycles that re-set monitors:

<http://www.mitchell1.com>

<http://www.alldata.com/techtips>

<http://www.obdii.com>

The direct link to this part of the site is <http://mass.gov/vehicletest/newsletters.html>



The *Enhanced Emissions & Safety Test* program is based on science, authorized by law, and run by the book.

But that doesn't mean everything about performing an inspection is spelled out in precise detail, and that all an inspector has to do is follow the manual.

Judy Dupille of the Registry of Motor Vehicles puts it best: "There are times when an inspector is more an umpire than a certifier, when he has to exercise his own good judgment and common sense."

As an example, she points to the rule on unnecessary noise from the muffler and exhaust system. "Unnecessary noise from these sources is defined as anything louder than that generated by a vehicle with an original equipment manufacturer's (OEM) muffler and exhaust in good running order," said Dupille, who serves as the RMV's Director of Vehicle Safety and Compliance.

"So, when a vehicle has an after-market replacement muffler, which is fairly common, the inspector has to accelerate the engine and decide if the vehicle is as loud, or louder, than that make and model is with an intact OEM muffler."

To make the right decision, "the inspector must call on his automotive knowledge, his experience in the inspection program, and his judgment skills," she said. "You could say that an inspector needs good ears *and* a good gut."

A thorough check of the muffler and exhaust system is a must during every inspection. "You can't just glance at these components and move on," Dupille said. "You must look closely at the entire system."

Among the defects inspectors should look for are:

- Any modification that causes excessive noise or smoke;
- Tailpipes that do not extend beyond the passenger compartment;
- Damaged, leaking, or deteriorated parts;
- Cut-outs from the muffler;
- Bypasses around the muffler;
- Any missing part;
- Loose parts and pipes;
- Parts and pipes secured in an incorrect position.

During the annual safety inspection, inspectors have to consider engine smoke, as well.

"Contrary to what most people think, the exhaust is not solely a matter for the emissions test," said Dupille.

Inspectors performing a safety inspection are required to run the engine at 1,000 to 1,200 RPMs; if any black or blue smoke is visible, the vehicle fails for safety.

"This requirement is *in addition* to the mandated tailpipe emissions test for gasoline-powered vehicles and the opacity emissions test for diesel-powered vehicles," Dupille emphasized.

Another reminder from Dupille concerned the tailpipe of passenger vehicles. "For obvious safety reasons, the muffler and exhaust pipes cannot have leaks, and the tailpipe must extend beyond the passenger compartment," she said. "When checking the exhaust system, remember that the trunk is considered part of the passenger compartment on all passenger vehicles. The tailpipe has to extend beyond the trunk."

The rule is applied differently to non-passenger vehicles, Dupille noted. For example, the tailpipe on a pick-up truck only has to go beyond the cab. ■

# Applus+ Taps I&M Veteran for Top Job in MA

Professionally, **Jack Pierce** is balanced comfortably on the line between new and old.

He's new to the job of Massachusetts program manager for Applus+ Technologies of the *Enhanced Emissions & Safety Test*, having taken over that position in late November when Darrin Greene resigned. And Pierce is a genuine I&M veteran, having been involved in the program from the days when it was in development.

Prior to joining Applus+'s predecessor six years ago, Pierce was executive director of the New England Service Station and Automotive Repair Association (NESSARA). In that capacity, he served on the I&M Advisory Committee, which helped the state design the enhanced program.

"I have years of experience working in government and in the automotive service and repair industry," said Pierce, 53, who served in the administration of former Governor Michael Dukakis. "This enables me to do my job effectively for Applus+ Technologies while also addressing the unique needs of the (service and repair) industry and the state agencies that supervise the I&M program."

For Applus+, Pierce said, the main priorities are "to uphold our commitment to high-quality customer service" and "to keep the program running smoothly."



*"I've always been proud to be a member of this team. Now I'm honored to be leading it."*

**-JACK PIERCE**

"I have no doubt we're going to meet those commitments," he said, adding, "I've always been proud to be a member of this team. Now, I'm honored to be leading it. The excitement of the promotion has not worn off."

Applus+ elevated Pierce to program manager from the position of assistant program manager for industry and motorist services.

Born and raised in Worcester, Pierce earned a bachelor's degree from the College of the Holy Cross (1973), and attended graduate school at Assumption College. He was a special education teacher in Worcester for eight years before going to work for Gov.

Dukakis as assistant director of personnel in 1985.

From 1987 to 1989, Pierce was the legislative director at the Registry of Motor Vehicles, a senior policy position. He returned to the State House in May 1989, to serve as Dukakis's deputy director of legislative affairs. When the governor left office in January 1991, Pierce became chief executive officer of NESSARA.

Pierce resides in Hubbardston with his wife, Roberta ("Bobbie"), and children, Joseph, 18, and Michelle, 15. ■

## Procedure for 'Manual Mode' OBD II Check

This procedure provides a 60-second sequence to determine which monitors are not ready.

- From the main menu Enter "F11" to select Diagnostic Menu.
- Enter "6" to select OBD II Test.
- Enter "1" to select Manual Mode.
- Enter "F3" to select Continue (DLC Location Menu).
- Enter "F10" to select Yes (Could the DLC be located and a connection made?).
- Enter "F10" or "Y" **after following the prompt** to select Continue. (Leave the key off a minimum of 12 seconds before continuing.) Press the Y button on the OBD II device, or press enter on the keyboard to continue the test after successfully connecting to the DLC and waiting at least 12 seconds.
- Enter "F10" or "Y" **after following the prompt** to select Continue. (Turn the ignition to start the engine and allow the vehicle to idle.) Press the Y button (on the OBD device) or press enter (on the keyboard) to proceed.

The monitor readiness status and any codes present will now be displayed. Click on the camera in the upper left hand corner to print. ■

## ENFORCEMENT ACTIONS

*September 1 – December 31, 2004*

**Violations Issued to Inspectors : 206**

**Violations Issued to Stations: 181**

**Inspectors Required to Retrain: 15**

**Inspector Privileges Revoked: 6**

**Inspectors Suspended: 31**

**Stations Suspended: 78**



# More Reliable Scanners Making Manual Entry Look So Yesterday

With the recent completion of the project to upgrade and replace all emissions testing equipment, the Registry of Motor Vehicles (RMV) may soon require all inspectors to make full use of their new barcode scanners. Scanners are designed to help ensure accurate data entry during an inspection and to reduce the time it takes an inspector to enter this data.

"The new barcode scanners are of a higher quality, so all inspectors should now scan in their inspector license numbers and sticker numbers," said **Mark C. LaFrance**, RMV project manager for Vehicle Safety and Compliance Services. "This is the fastest, most accurate way to enter those numbers into the workstations."

Many inspectors had problems scanning in their inspector license numbers, sticker numbers and vehicle identification numbers (VINs) with the old scanners, LaFrance explained, so they frequently opted to enter these numbers manually. "The new scanners should be much better than the old," he said, "and if they are not, inspectors should not hesitate to make a service request."

The current software continues to allow inspectors to enter inspector license numbers, sticker numbers and VINs manually, but at some point, it may be updated to eliminate this option. "So it's a good idea for inspectors to get in the habit now of scanning these numbers," LaFrance said. ■

## ***DON'T FORGET!***

*Give a Vehicle Emissions Repair Packet to every motorist whose vehicle fails the Enhanced Emissions & Safety Test*



### **Where to Turn When You Have a Question**

**Department of Environmental Protection**  
617-292-5745  
Program issues

**Station Hotline**  
877-297-5552  
For workstation and other equipment problems

**Motorist Hotline**  
877-387-8234  
For consumer issues

**Registry of Motor Vehicles**  
617-351-9333  
For various Registry issues

**Web Site**  
[www.mass.gov/vehicletest](http://www.mass.gov/vehicletest)  
General program information

printed on recycled paper

*A Master Trainer's Invaluable Lesson, Pages 6 & 7*

## **Learning to Embrace the Meaning of Resistance**

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