



April 1, 2013

The Hon. Fred Upton, Chairman
Committee on Energy and Commerce
United States House of Representatives
Washington, DC 20515

The Hon. Henry Waxman, Ranking Member
Committee on Energy and Commerce
United States House of Representatives
Washington, DC 20515

Dear Chairman Upton and Ranking Member Waxman:

With more than 1500 members representing boat, engine, trailer, and accessory manufacturers, the National Marine Manufacturers Association is the largest trade association representing the recreational marine manufacturing industry. We very much appreciate the opportunity to comment on the issue of ethanol blends in gasoline. Our industry has been at the forefront of testing of such blends, working under the auspices of the United States Department of Energy to test the effects of non-ethanol gasoline, gasoline with 15% ethanol content by volume, and gasoline blends containing butanol. Our comments today are restricted to the effects of e15 blend on marine engines.

As you can readily see from the attached comments, we have determined that e15 blends of ethanol would cause considerable damage to the 7.5 million outboard engines in use in this country today. This damage is unnecessary and can be avoided by freezing the ethanol content of gasoline at 10% by volume. NMMA has never been anti-ethanol. We are simply opposed to fuel blends that will ruin our engines and place lives at risk.

If you would like additional information on the tests we conducted or wish to discuss our submission, please feel free to contact NMMA Legislative Director Jim Currie at 202 737-9760 or at jcurrie@nmma.org.

Sincerely,

Thomas J. Dammrich
President

Executive Committee

Chairman, NMMA
Mark Schwabero
Mercury Marine

Vice Chairman, NMMA
Joan Maxwell
Regulator Marine

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**Response to House Energy & Commerce Committee
White Paper #1 on the Renewable Fuel Standard
Submitted by the
National Marine Manufacturers Association
April 1, 2013**

Question #2: What are the benefits and risks of expanded use of E-15 to automakers, other gasoline powered equipment makers, refiners, fuel retailers, and others involved in the manufacture and sale of gasoline and gasoline-using equipment?

Answer: Outboard engines are perhaps the toughest gasoline engines made, but they are not designed to run on e15 blend gasoline and will be damaged if such an ethanol blend is used in them. No manufacturer of outboard engines warrants their engines to run on an ethanol blend above 10% by volume, and all of them state unequivocally that using an ethanol blend above 10% will void the engine's warranty. The reason for this warning is quite simple: testing has demonstrated that blends at 15% ethanol will absolutely destroy an outboard engine.

Mercury Marine, a division of the Brunswick Corporation located in Fond du Lac, Wisconsin, has been a manufacturer of recreational marine engines since 1939, and it currently makes and sells more marine engines than any other manufacturer in the world. In 2010 and 2011 Mercury Marine tested e15 blend fuel in three different Mercury outboard engines. These tests were conducted at the Mercury Marine test facility in Fond du Lac by Mercury personnel under contract to the US Department of Energy and coordinated by the National Renewable Energy Lab (NREL). The final report was released by the Department of Energy in October 2011 and can be found at the following web site:
<http://www.nrel.gov/docs/fy12osti/52909.pdf>

The objective of these tests was to understand the effects of running a 15% ethanol blend on outboard marine engines during 300 hours of wide open throttle (WOT) endurance testing—a typical marine engine durability test. Three separate engine families were evaluated. A 9.9 HP carbureted four-stroke engine and a 300 HP supercharged electronic fuel injected four-stroke engine represented current products. A 200 HP electronic fuel injected two-stroke engine was chosen to represent the legacy products still in widespread use today. Two engines of each family were evaluated. One engine was endurance tested on e15 fuel, while a second control engine was endurance tested on ethanol-free gasoline.

Ethanol is an oxygenator. E10 fuel has 3% oxygen, while e15 fuel has 5% oxygen. In a typical marine engine this additional oxygen makes the fuel burn hotter, and the higher temperatures can reduce the strength of the metallic components. In addition, because of the chemical interaction, ethanol can cause compatibility issues with the other materials in the fuel systems.

Mercury was able to complete the entire 300 hour test running e15 in the 9.9 HP engine. Test results indicated poor running quality, including the occurrence of engine misfires toward the end of the test.

The poor run quality caused an increase in exhaust emissions. In addition, there were increased carbon deposits in the engine on the underside of the pistons and on the ends of the rods, indicating higher engine temperatures. The photo at the end of this narrative shows the difference in the carbon deposits on the engines run on e0 and e15. Additionally, deterioration of the fuel pump gasket was evident on the e15 engine. This deterioration of the gasket could lead to fuel pump failure, disabling the engine.

The 300 HP four-stroke supercharged Verado engine did not complete the endurance test on e15 fuel. The engine encountered a valve failure after 285 hours of endurance testing. As the photos clearly show, one valve broke apart, which ended the test, and two others developed cracks. These are quality valves constructed of Inconel, a high-temperature alloy. Even so, when Mercury did metallurgical analysis on this engine, it found that the cause of these fractures was deteriorated mechanical strength due to high metal temperature. The next photos show a comparison of the pistons and connecting rods from the Verado engine, also indicating that the e15 test engine operated at elevated temperatures.

The 200 HP two-stroke engine using e15 fuel also failed to complete the endurance test. It failed a rod bearing at 256 hours of testing, resulting in catastrophic destruction of the engine. The photo clearly shows the damage. There was so much damage to the engine that Mercury could not determine the exact cause of failure. Two-stroke engines mix the fuel and the oil and use that mixture to distribute the oil to the critical interfaces such as the bearings and cylinder walls, and ethanol may have an effect on the dispersion or lubricity of the oil mixed with the fuel.

Despite the limited nature of this testing, several significant issues were identified. In addition to the need for more 2-stroke lubrication system testing, more testing is needed to understand how e15 fuel affects marine engines during other operating conditions. Examples would include starting, acceleration/deceleration, and the effect of e15 fuel on marine engines that are stored with fuel in the system over long periods of time, as occurs regularly with marine engines.

What is presented in this response today—and what is available at the DOE website in full—are the results of the limited testing conducted on three of Mercury’s outboard engine families. This study showed how fueling marine engines with e15 may cause a variety of issues for owners and can lead to premature engine failure. There are approximately 7.5 million outboard engines in use today, and every one of them would be threatened with damage or destruction if e15 became the common fuel in the marketplace.

If we extrapolate to other types of engines such as those in motorcycles, snowmobiles, and all-terrain vehicles (ATVs)—which is perfectly fair and reasonable, as the combustion chemistry is the same as for marine outboards—we can see the potential for even more extensive repair and replacement costs to the American consumer, costs that could range into the billions of dollars. If you have a lawnmower or a chain saw or a generator, the principles are the same: high heat comes from the additional oxygen in an e15 blend, and high heat will damage your engine. And if you have an older automobile or truck—anything older than 2001 model year—the EPA says you should not run e15 in it. There are over 120 million older vehicles of this type on American roads today.

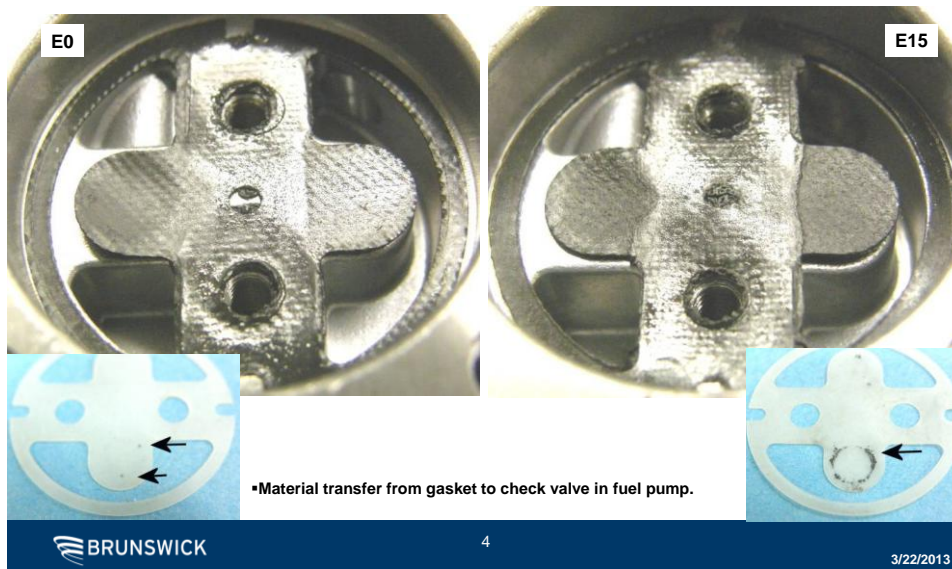
Damage to marine engines also carries implications beyond those applicable to automobiles. If an automobile engine breaks down because of ethanol damage, it is a simple matter to pull over to the side of the road and wait for the tow truck. If a boat engine is damaged, the boater might well be miles at sea. The United States Coast Guard was undoubtedly considering this scenario when it told the EPA in a July 2, 2009, letter that the EPA's proposed waiver to allow the sale of e15 "has raised concerns related to possible reduction in the level of safety for recreational boaters . . ." As a result, said the Coast Guard, it could not support the waiver to allow e15 usage.

NMMA does not see any benefits in the expanded use of e15. It is certain that if e15 were to become the common fuel in the marketplace, extensive misfueling would occur, with consequent damage to marine and other engines. We do not believe that there would be any benefit to the American consumer as a result of wide-spread availability of e15 blend gasoline. Rather, any American consumer who owns any gasoline-powered equipment, whether boat, snowmobile, motorcycle, ATV, lawnmower, chain saw or weed whacker, would almost certainly incur the expense of repair or replacement of that equipment because of the damage caused by e15 use. In the case of boats, motorcycles, ATVs and snowmobiles, that cost could be in the thousands of dollars per vehicle. These are costs that are totally avoidable by changing the RFS to reflect the knowledge and understanding about ethanol-blended fuels we have gained since 2007.

Photos from Mercury Marine Outboard Tests

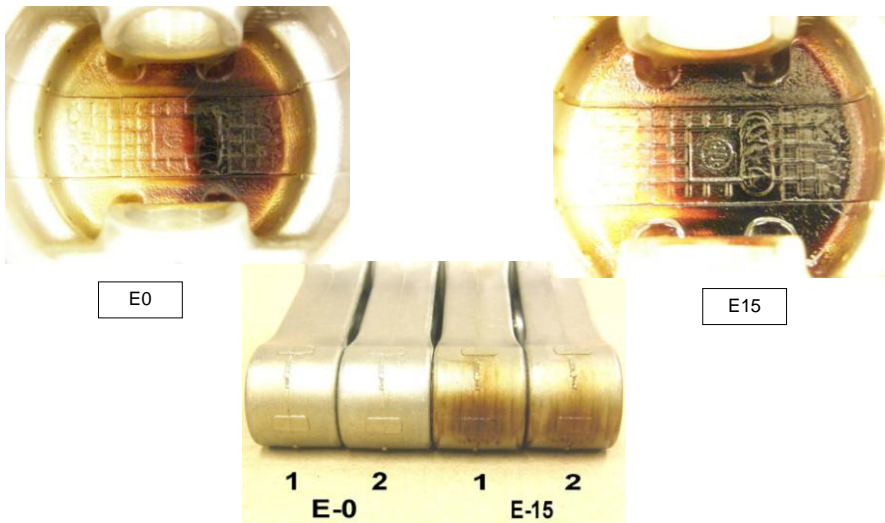
9.9HP Carbureted 4-Stroke

- The fuel pump gasket showed signs of deterioration on the E15 engine compared with the E0 (pure gasoline) engine.



9.9HP Carbureted 4-Stroke

- More carbon deposits on piston underside and rods of E15 engine.

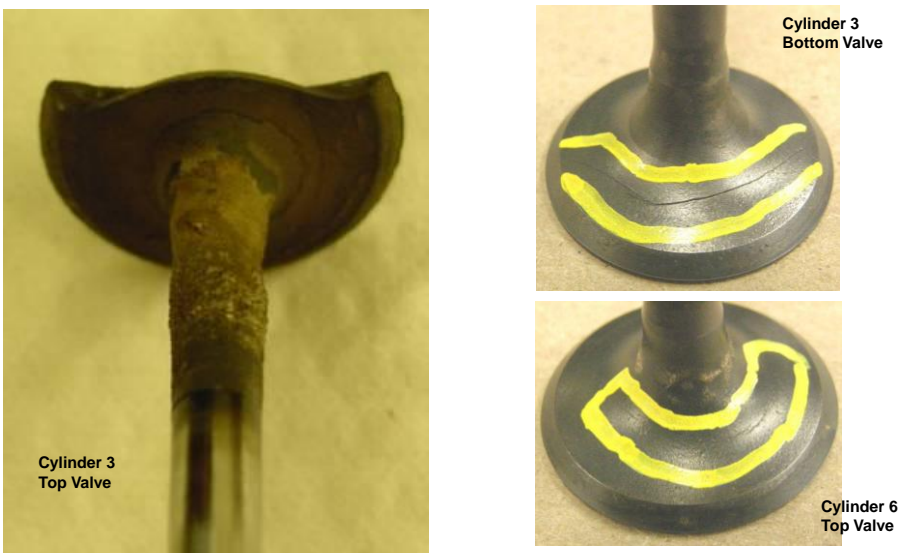


BRUNSWICK

1

1/29/2013

300HP Supercharged 4-Stroke



BRUNSWICK

2

1/29/2013

300HP Supercharged 4-Stroke

- Carbon deposits may indicate that the E15 engine's pistons and connecting rods were hotter during operation than those in the E0 engine.



BRUNSWICK

3

1/29/2013

200HP EFI 2.5L 2-Stroke

Recovered Pieces from Failed Rod Bearing

Undamaged Bearing



Undamaged Rod Damaged Rod



BRUNSWICK

4

1/29/2013

Question #3. What are the risks of the introduction and sale of E-15 to the owners of pre-2001 motor vehicles, boats, motorcycles, and other gasoline-powered equipment not approved to use it? How do these risks compare with the benefits of the RFS?

Answer: As mentioned above in answer to Question #2, one of NMMA's member companies tested e15 gasoline blend on new, right-off-the-production-line outboard engines and determined that this blend of ethanol damages engines because of the additional oxygen it provides to the combustion chamber. These findings would be applicable to all marine outboard engines in use today, including those manufactured prior to 2001. There are approximately 7.6 million outboard engines on registered boats today, plus over 1 million personal watercraft whose engines would be affected adversely by higher ethanol blends. The repair and replacement costs if these engines were damaged by e15 blend, would likely reach into the billions of dollars. This is a cost to the American consumer which is easily avoided by changing the RFS so that it does not allow ethanol blends exceeding 10% by volume. There will be outcries from the corn farmers and the ethanol producers, but it seems to NMMA that the United States Government should not enact policies like the Energy Security and Independence Act of 2007 that require the American consumer to purchase a product which will harm the very device that he puts it into. We believe that the RFS, while well-meaning, was enacted before we knew the full effect that increasingly-high blends of ethanol has on gasoline-powered equipment. Now that we know these effects, we believe it is time to change the RFS to reflect the current state of knowledge. Based on our testing, we see no benefits to the ever-increasing amounts of ethanol that the RFS requires be blended into our fuel supply between now and 2022.